



THE JOHN CRERAR
LIBRARY • CHICAGO.

1894

PRESENTED BY

Universit 





Digitized by the Internet Archive
in 2012 with funding from
University of Illinois Urbana-Champaign

*378.111
W.H. need*

University of Arizona Record

VOLUME III, NUMBER 5

MAY, 1911

REGISTER 1910-11

WITH ANNOUNCEMENTS FOR 1911-12

PUBLISHED BY THE
UNIVERSITY OF ARIZONA
TUCSON, ARIZONA

THE UNIVERSITY OF ARIZONA

TUCSON, ARIZONA

DEPARTMENTS OF UNIVERSITY WORK

The General College Course leading to the Degree of Bachelor
of Arts

Agriculture—the Four-Year Course and the Short Course

Civil Engineering

Electrical Engineering

Mechanical Engineering

Mining Engineering

Metallurgy

The Mechanic Arts

The Agricultural Experiment Station

The Preparatory Department

All of these departments of work are situated at Tucson, insuring
the unity of the University, breadth, efficiency, and economy of
instruction and administration.

Address all correspondence to

ARTHUR H. WILDE, President,

The University of Arizona,

Tucson, Arizona.

*RECEIVED
UNIVERSITY OF ARIZONA LIBRARIES*

University of Arizona

REGISTER

1910-11

WITH ANNOUNCEMENTS FOR

1911 - 12

TUCSON, ARIZONA

1911

HAF

THE ANNUAL REGISTER

CALENDAR

1911

Sept. 21, Thu.	Entrance examinations
Sept. 22, Fri.	Condition examinations
Sept. 21, Mon.	Registration day
Sept. 26, Tues.	First semester begins
Nov. 22, Wed.	Thanksgiving Recess begins
Nov. 27, Mon.	Instruction resumed
Dec. 22, Fri.	Holiday Recess begins

1912

Jan. 2, Tues.	Instruction resumed
Jan. 25, 26, 27.	First semester examinations
Jan. 27, Sat.	First semester ends
Jan. 29, Mon.	Second semester begins
Feb. 22, Thu.	Holiday
May 29, 31,	
June 1.	Second semester examinations
June 2, Sun.	Baccalaureate discourse
June 4, Tues.	Exhibition military department
June 5, Wed.	Commencement

OFFICERS OF ADMINISTRATION, INSTRUCTION AND INVESTIGATION

BOARD OF REGENTS

EX-OFFICIO

HON. RICHARD E. SLOAN, A. B. Phoenix
HON. KIRKE TANNER MOORE, LL. B. Phoenix

APPOINTED BY THE GOVERNOR Term Expires

HON. MERRILL P. FREEMAN, Tucson. August, 1913
Chancellor and President

HON. CHARLES H. BAYLESS, A. M., Tucson. August, 1913
Treasurer

HON. JOHN C. GREENWAY, Warren. April, 1915
HON. WILLIAM J. MURPHY, Phoenix. 1915

REGULAR MEETINGS ON THE 10TH OF EACH MONTH

FACULTY

KENDRIC CHARLES BABCOCK, Ph. H., President.

B. L., 1889, Minnesota; A. M., 1895, Harvard; Ph. D. 1896,
Harvard.

Resigned December, 1910. Professor of History and Economics.
1903.

ARTHUR HERBERT WILDE, Ph. D.

President's House, University Campus

B. A., 1887, Boston University; M. A., 1899, Ph. D., 1901,
Harvard.

President, May, 1911. Professor of History

ANDREW ELICOTT DOUGLASS, Sc. D. Olive Road and Speedway
A. B., 1889; Sc. D., 1908, Trinity.

Acting President, December, 1910, to May, 1911. Professor of
Physics and Astronomy. 1906

*Dates following titles indicate appointment to service in the University.

378.73 /

UH1

157280
319268

ROBERT HUMPHREY FORBES, M. S.	University Campus B. S., 1892, M. S., 1895, Illinois. Director and Chemist, Agricultural Experiment Station. 1894
FRANK NELSON GUILD, M. S.	Olive Road B. S., 1894, M. S., 1903, Vermont. Professor of Chemistry and Mineralogy. 1897
†GEORGE EDSON PHILIP SMITH, C. E.	1195 Speedway B. S., 1897, C. E., 1899, Vermont. Irrigation Engineer, Agricultural Experiment Station. 1907
JOHN JAMES THORNBER, A. M.	Olive Road B. S., South Dakota (Agricultural); B. S., 1897, A. M., 1901, Nebraska. Professor of Biology; Botanist, Agricultural Experiment Station. 1901.
CYRUS FISHER TOLMAN, Jr., B. S.	521 E. Third St. B. S., 1896, Chicago. Professor of Geology and Mining Engineering. 1905.
WILLIAM WHEELER HENLEY, A. B.	First St., near Vine St. A. B., 1905, Leland Stanford, Jr. Professor of Mechanical Engineering and Mechanic Arts. 1905
ANDREW ELICOTT DOUGLASS, Sc. D.	Olive Road and Speedway A. B., 1889; Sc. D., 1908, Trinity. Professor of Physics and Astronomy. 1906
*ALBERT EARLE VINSON, Ph. D.	914 N. Fourth Ave. B. S., 1901, Ohio (State); Ph. D., 1905, Goettingen. Biochemist, Agricultural Experiment Station. 1905
CHARLES ALFRED TURRELL, A. M.	835 Tyndall Ave. B. S., 1896, Nebraska; A. M., 1901, Missouri. Professor of Modern Languages. 1904
LESLIE ABRAM WATERBURY, C. E.	327 E. Fourth St. B. S., 1902; C. E., 1905, Illinois. Professor of Civil Engineering. 1907

†Absent on leave.

*Absent six months on leave.

- ROBERT RHEA GOODRICH, M. S. 645 E. Third St.
B. S., (Mining), 1885; B. S., (Mechanical Eng.), 1901;
M. S., 1902, Massachusetts Institute of Technology.
Professor of Metallurgy. 1907
- ROBERT WAITMAN CLOTHIER, M. S. 923 E. Sixth St.
B. S., 1897; M. S., 1899, Kansas (Agricultural).
Professor of Agriculture; Conductor of Farmers' Institutes.
1907
- ERNEST SUTHERLAND BATES, Ph. D. 908 Speedway
A. B., 1902; A. M., 1903, Michigan; Ph. D., 1908, Columbia.
Professor of English. 1908.
- HENRY ALFRED ERNEST CHANDLER, B. S.
North Hall, University Campus
B. S., 1905, Northwestern.
Professor of Economics and History. 1908
- NATHAN CESNA GRIMES, A. M.
A. B., 1906, Michigan; A. M., 1909, Wisconsin.
Professor of Mathematics. 1910
- HIRAM McL. POWELL. 925 Tyndall Ave.
Captain U. S. A., 1890, West Point.
Professor of Military Science and Tactics. 1909
- GEORGE FOUCHE FREEMAN, B. S. 817 E. Fifth St.
B. S., 1903, Alabama Polytechnic Institute.
Plant Breeder, Agricultural Experiment Station. 1909
- AUSTIN WINFIELD MORRILL, Ph. D. 235 W. Monroe St., Phoenix
B. S., 1900, Massachusetts Agricultural College; B. S.,
Boston, 1900; Ph. D., 1903, Massachusetts Agricultural
College.
Entomologist, Agricultural Experiment Station, and of Arizona
Horticultural Commission. 1909
- FREDERICK W. WILSON, B. S. Experiment Station Farm, Phoenix
B. S., 1905, Kansas (Agricultural).
Animal Husbandman, Agricultural Experiment Station. 1905

WILLIAM GEORGE MEDCRAFT, A. M.

Rust Flats, First Ave. near Third St.

A. B., 1898; A. M., 1904, Kansas Wesleyan.

Assistant Professor of Mathematics. 1905

RAYMOND C. BENNER, Ph. D. Fourth St. and Highland Ave.

B. S., 1902, Minnesota; M. S., 1905; Ph. D., 1909, Wisconsin.

Assistant Professor of Chemistry. 1906

FRANCES MELVILLE PERRY, A. M.

B. A., 1891, Butler; A. M., 1893, Butler.

Assistant Professor of English. 1910

WILLIAM HORACE ROSS, Ph. D. 833 E. Fourth St.

B. S., 1903; M. S., 1904, Dalhousie; Ph. D., 1907, Chicago.

Assistant Chemist, Agricultural Experiment Station. 1907

FRANK CALEB KELTON, B. S. 412 E. Fourth St.

B. S., 1904, Arizona.

Assistant Engineer, Agricultural Experiment Station. 1909

LEVONA PAYNE NEWSOM, Ph. D. Fourth St. and Euclid Ave.

A. B., 1892; Ph. D., 1895, Franklin.

Assistant Professor of Latin and Greek. 1905

MARION CUMMINGS STANLEY, B. L. Center St. near Speedway

B. L., 1900, California.

Assistant Professor of Philosophy. 1902

CHARLES HENRY CLARK, B. S. A.

B. S. A., 1908, North Dakota.

Assistant Plant Breeder, Agricultural Experiment Station. 1910

ALEXANDER McOMIE, B. S.

B. S., 1910, Utah.

Assistant Agriculturist, Agricultural Experiment Station. 1910

ESTELLE LUTRELL, A. B.

731 No. First Ave.

A. B., 1896, Chicago.

Instructor in English, Librarian. 1904

FREDERICK EDWIN TALMAGE, B. L.

Olive Road

B. L., 1903, California.

Instructor in Stenography and Bookkeeping. 1904

IDA CHRISTINA REID, Ph. B. 149 E. Pennington St.
Ph. B., 1906, Arizona.

Instructor in History and Mathematics. 1906

LOUISE MARIE PETERS, A. M.
B. A., 1902, California.

Instructor in Modern Languages. 1910

FRANK LEWIS KLEEBERGER, B. S. South Hall, University Campus
B. S., 1908, California.

Instructor in Chemistry and Physical Training; Director of the
Gymnasium. 1908.

WILLIAM LUCIUS FOWLER, B. S. South Hall, University Campus
B. S., 1909, Missouri.

Assistant Professor of Animal Husbandry. 1909

BERT AUGUSTUS SNOW, B. S.

B. S., 1907, Col. Ag.; M. E., 1910, Cornell.

Instructor in Electrical and Mechanical Engineering. 1910

JAMES GREENLEAF BROWN.

Olive Road

Instructor in Botany. 1909

WILLIAM JAMES GALBRAITH, JR.

725 E. Fourth St.

A. B., 1906, Leland Stanford Jr.; J. D., 1908, Chicago.

Instructor in Law. 1909

JOSEPHINE MACK, B. A.

Park Ave. and Speedway

B. A., 1910, Lake Forest.

Instructor in English and Physical Training. 1910

ARTHUR HAMILTON OTIS, A. B.

A. B., 1908, Columbia.

Instructor in Modern Languages. 1911-12

IDA W. DOUGLASS, Ph. B.

Olive Road

Ph. B., 1910, Arizona.

Instructor in Physical Geography. 1910

ANGELA E. O'BYRNE.

Instructor in Music. 1910.

*Resigned May 1, 1910.

ADMINISTRATIVE OFFICERS AND ASSISTANTS

- FREDERICK EDWIN TALMAGE, B. L. Olive Road
Secretary of the University, 1904.
- E. DANA TROUT, 803 E. Seventh St.
Secretary of the Agricultural Experiment Station, 1909.
- MILES M. CARPENTER, B. S. North Hall, University Campus
Clerk in President's Office, 1907.
- HERBERT BROWN, 220 N. Court St.
Curator of the Territorial Museum
- MRS. I. T. UNDERHILL, West Cottage, University Campus
Preceptress of Young Women, 1910.
- ARTHUR W. OLcott, M. D. 237 N. Main St.
Medical Examiner for Men, 1905.
- WILLIAM LUCIUS FOWLER, B. S. South Hall, University Campus
Head of South Hall, 1910.
- HENRY ALFRED ERNEST CHANDLER, B. S.
Head of North Hall, 1909.
- WALTER M. COLE, University Campus
Superintendent of Grounds, 1907.
- MISS MABEL A. GUILD
Assistant Librarian
- MINER LOUIS HARTMAN
Assistant in Chemistry
- RALPH W. HARRISON
Assistant in Metallurgy
- LOYD C. ELLIOTT
Assistant in Physics

FRED W. RODOLF
Assistant in Civil Engineering

ALICE P. LAWSON
Assistant in Botany

JAMES L. BONE
Assistant in Mechanical Engineering

STANDING COMMITTEES—1910-1911

The President is ex-officio member of all committees

Registration and Classification
Professors Guild, Waterbury, Medcraft, Chandler, Perry

Library
Miss Lutrell, Professors Waterbury, Turrell, Bates

Public Exercises
Professors Chandler, Medcraft, Miss Lutrell

Co-operative Association
Mr. Talmage

Rhodes Scholarship
President Wilde, Professors Guild, Bates

UNIVERSITY OF ARIZONA

Established by Act of Legislative Assembly, 1885; Open to Students,
October, 1891

PURPOSE AND ORGANIZATION

The University of Arizona is an integral part of the system of public education established by and for the Territory, and aims, as the head of such system, to fill the same position as that occupied by the state universities in such states as California and Wisconsin. Its general organization is in accordance with the Act of Congress of July 2, 1862, known as the Morrill Act, creating the "Land Grant Colleges." The details of its organization and government are regulated by the Act of the Legislative Assembly of the Territory of Arizona, passed in 1885, and embodied, with amendments, in the Revised Statutes of Arizona Territory, 1901, which vests the government of the institution in a corporation styled the Board of Regents of the University of Arizona, consisting of the Governor and Superintendent of Public Instruction of the Territory, *ex-officio*, and four other members appointed by the Governor for a term of four years.

In creating the University, the Legislative Assembly wisely followed the example of the great states of Wisconsin, Illinois, Minnesota, Nebraska, and California, in unifying under one management the various schools and institutions of higher learning or investigation in Arizona,—the colleges of liberal arts, the schools of mining and engineering, the agricultural college, and the agricultural experiment station, which in some states have been widely and completely separated. No professional schools of law, medicine, dentistry, or music have been established. In compliance with the provisions of the Act creating it, the University consists of

- I. The College of Agriculture and Mechanic Arts.
- II. The School of Mines.
- III. The Agricultural Experiment Station.
- IV. The Preparatory Department.

The Normal Department, authorized by the statute, has not yet been organized. The Preparatory Department, which is really a complete manual training high school with a four years course, will gradually disappear as the educational system of the Territory is developed by the establishment of efficient high schools, but no date is set for abolishing even the first year of this preparatory course.

The University in all departments is open to properly qualified persons of both sexes. Through the aid received from the United States and from the Territory, it is enabled to offer its privileges to residents and non-residents, with only very moderate charges. The number of students in any one class or section of a class is kept below twenty, in order that each student may receive the individual attention of the instructors and thus gain the full advantage derivable from a small school.

The purpose of the University of Arizona is, in the language of the organic law, "to provide the inhabitants of this Territory with the means of acquiring a thorough knowledge of the various branches of literature, science, and the arts," and so far as possible a technical education adapted to the development of the peculiar resources of Arizona. In furtherance of this latter purpose, instruction is provided especially in subjects fundamental to agriculture, the mechanic arts, mining and metallurgy. The University, by the nature of its situation, frankly lays special emphasis upon the course in mining engineering. It is, in reality, a great mining laboratory, surrounded as it is on all sides by great mines. Some of these mines developed on a large scale are within a few miles of the city, and the number and magnitude of such enterprises are steadily increasing. Probably no University in the United States offers such fine advantages to the students of mining engineering who desire to see the actual operation of great mines, or the development of great enterprises, while carrying on the theoretical and experimental work of the mining course.

The advantages in civil engineering are hardly less noteworthy, for Tucson is not only a division point on the main line of the Southern Pacific railroad, with large shops, roundhouses, and engineering offices, but it has the administrative and engineering headquarters for five of

the subsidiary or allied lines of the Southern Pacific system in Arizona and in Sonora, Mexico, commonly known as the Randolph lines, including the great West Coast Line which will reach from Guaymas to Mazatlan and Guadalajara, in Mexico. All of these lines are undergoing extensive expansion and re-building, and so furnish excellent opportunities for observation and vacation employment for students of civil engineering.

LOCATION AND CLIMATE

The University of Arizona is located at Tucson, a city of eighteen thousand inhabitants, on the main line of the Southern Pacific railway, 312 miles west of El Paso, Texas, and 500 miles east of Los Angeles, California. The city lies in a broad flat valley at an elevation of 2,400 feet above sea level and is surrounded by mountains. Its dry, mild, and equable climate has made Tucson a famous winter resort unsurpassed for healthfulness.

The winter climate is especially good; the temperature is cool and strengthening but not severe, the lowest temperature recorded during the average year being about twenty degrees above zero, Fahrenheit. Little rain falls during the winter; fogs are all but unknown; cloudy days are rare. The percentage of sunshine throughout the winter is greater than that recorded at any other place in the United States. Owing to the extreme dryness of the air the highest temperatures known are less oppressive to the senses and less dangerous to the health than the summer heats of the upper Mississippi Valley states. The total amount of rainfall averages less than twelve inches.

These advantages insure to students a comfortable education and a wide range of out-door sports and recreations throughout the college year.

The University Campus, consisting of fifty-five acres, is situated upon high ground about a mile from the business center of the city with which it is connected by an excellent electric street-car line. On every side it commands a view of mountain scenery of remarkable extent and grandeur. The buildings are lighted by electricity furnished by the city plant.

An abundant supply of unusually good water for household, labora-

tory, and irrigation purposes is drawn from a large well on the Campus from a depth of one hundred and twenty feet, thus securing immunity from the dangers of a contaminated water supply. The Campus has a complete sewer system connecting all the buildings, with one exception, with the city mains at the University gate.

The Campus, carefully laid out in drives, lawns, and gardens, with a large number of palms, olive, ash, umbrella, pepper, bagota, and cottonwood trees has the air of a well kept park.

BUILDINGS

The main building, University Hall, the oldest of the group, is 200 x 150 feet, two stories in height, the first of gray stone, the second of red brick. It is completely surrounded by a wide two-story veranda. The building contains recitation rooms, laboratories and apparatus rooms of various departments, an assembly room, and the office, laboratories and library of the Agricultural Experiment Station.

The Library and Museum building is a handsome structure of red brick and Bedford sandstone, with a massive tile roof. The interior finish is in natural oak and pine. The library reading room, on the second floor, is a large, well-lighted room, beautifully furnished with heavy solid oak reading tables, desks and wall cases. The stack room at the rear is fitted up with the most modern steel racks. The Museum occupies parts of the first floor and the west half of the second floor. Fine oak and plate glass cases constitute the furnishings. The offices of the president and secretary of the University, three lecture rooms for the departments of geology, mathematics, English and history, work rooms for the library and museum, and a laboratory for the department of geology are on the first floor.

Science Hall, a new building, of architecture harmonious with the Library, which it faces, was completed in April, 1909, at a cost of about \$40,000. Further appropriation was made in March, 1909, for furnishing and equipping the building, which was thus made ready for occupancy in September, 1909. The building, 145 x 60 feet, is of three stories, the first devoted to physics, the second to chemistry and mineralogy, and the third to botany and biology. The roomy attic and a superstructure on the roof are used as an astronomical observa-

tory. The forty rooms provided by this Science Hall give excellent accommodations in place of the crowded quarters endured by several departments in recent years in University Hall, and the removal of these departments to the new building gives the Agricultural Experiment Station much needed space for its expanding work.

North Hall, a dormitory, two stories in height, built of gray stone of fine quality, is occupied by the college men. Besides the parlor, and rooms of the instructor in charge, it contains seventeen rooms, each large enough to accommodate two students, besides bath and toilet rooms.

South Hall, a large brick building containing forty rooms, besides bath and toilet rooms and store rooms, is the dormitory mainly for preparatory students. It is heated by a hot water system. It will accommodate seventy-five students.

West Cottage, with its new four-room annex, is the dormitory for young women,—a two story brick house with wide porches, surrounded with vines, shrubbery, lawns and trees.

East Cottage furnishes additional accommodations for young women.

The Dining Hall, built of red brick, provides ample boarding accommodations for all persons living on the Campus.

The Shop and Assay building is a large, substantial brick structure. It contains a commodious drawing room for mechanical and free-hand drawing, a large laboratory for forge work, machine practice and carpentry, and a lecture room, instrument room, and material testing laboratory for the department of civil engineering. Two other rooms are used for lockers, and for the motor and engine. The assay laboratory and commercial assaying department occupy five rooms fully equipped with a large melting furnace, the necessary muffle furnaces, and other accessories for making complete and accurate assays.

The Mill or Mining Machinery building, located to the northeast of the main group of buildings, is a plain wooden structure in which are placed the stamp mills, jigs, concentrating tables, separators, etc., necessary for the mining laboratory.

Herring Hall, the gymnasium, is a very substantial high building, 40 x 80 feet, constructed of red brick and white plaster. It was erected in 1903, the gift of Professor James Douglas and his associates of the Copper Queen Consolidated Mining Company, through Colonel William Herring, after whom it was named, at the suggestion of Professor Douglas.

The pump house and mechanical engineering laboratory was built in 1905. By use of brick, cement and iron it is practically fire proof, thus insuring safety to the well and pumps supplying the University with water for all its uses.

A two-story brick residence is occupied by the President of the University.

Other buildings are the cottage occupied by the Superintendent of Buildings and Grounds, three greenhouses, a brick barn, and various smaller outbuildings used for shops and store rooms.

MAINTENANCE

The University is maintained by funds appropriated by the United States and by the Territory of Arizona. Fifty-seven sections of very valuable pine land in Coconino county have been set apart by the Federal government for the benefit of the University, but title and control of the land does not pass to the Board of Regents until the Territory is admitted as a State. In the meantime only a small sum is annually received from the leases of this land.

By the provisions of the Morrill Act of 1890, the University receives annually from the United States the sum of \$25,000 "to be applied only to instruction in agriculture, the mechanic arts, the English language and the various branches of mathematical, physical, natural and economic science, with special reference to their applications in the industries of life, and to the facilities for such instruction." This Morrill Fund is to be ultimately duplicated by the Nelson Fund, created by the Act of March 4, 1907, which appropriated \$5,000 for the year beginning July 1, 1907, and provided for an annual increase of \$5,000 until the total received by each state should be \$50,000 per year from the two funds. For the current year this fund amounted to \$45,000. The University receives from the same source, for the

support of the Agricultural Experiment Station, \$15,000 yearly from the Hatch Act of 1887; the Adams Act of 1906, for the current year yields \$13,000, which is to be increased annually by \$2,000 until it also produces \$15,000, giving the Station ultimately \$30,000 per year.

The appropriations by the Territorial Legislative Assembly of 1909 were \$35,000 per year, for two years, for maintenance; \$13,100 for the work of the Agricultural Experiment Station for two years; and \$11,500 per year for two years for improvements.

In 1909 the El Paso & Southwestern System gave the University \$2,000 for the work of the Agricultural Experiment Station in carrying on experiments in dry farming in Cochise county.

The University also receives annually, from miscellaneous sources such as matriculation and tuition fees, rent of cottages, damage to University property, etc., about \$1,500. The receipts for board, light, etc., amount to about \$16,000 per year.

ENDOWMENT

By the munificence of Doctor James Douglas, of New York, the University received in June, 1908, "the sum of \$10,000 * * * the annual interest or income from which is to be annually applied, devoted, expended and used by said Board of Regents, or its successors in trust, for the purchase of instruments of precision and research, or special apparatus, for scientific instruction and education in the department of mineralogy and School of Mines of the University of Arizona, * * * but no part of said fund or income is to be used or applied to the purchase of mining or metallurgical machinery or supplies for such department or for the use of students in the chemical or metallurgical laboratories." The fund thus created has been named by the Board the Douglas Endowment Fund.

The Philo Sherman Bennett Scholarship is endowed by the gift of \$500 to the University in 1905, through the agency of Mrs. William Jennings Bryan, the income to be used in aiding young women to secure an education.

LIBRARY

The library contains 16,500 bound volumes and several thousand unbound bulletins and reports, chiefly agricultural. The accessions

for the scholastic year 1910-11 total 1500 volumes, exclusive of government documents. Since, of these accessions nearly one-half has been made within the last five years the books, as a whole, have a direct bearing upon the college work now offered. Of these volumes a collection of complete sets of scientific and literary periodicals, to which additions are made yearly, is of special service in reference work. The library was made a regular depository of United States Government documents in 1907. These publications have been placed in a separate room where they are arranged and numbered according to the government check list. The library of the Experiment Station in University Hall contains a very complete set of State Experiment Station literature, together with the card index to this material issued by the U. S. Department of Agriculture.

The books are classed by the decimal system and shelved in numerical order with a further author division according to the Cutter numbers. The catalogue is the usual dictionary card catalogue of authors, subjects and titles in one alphabetical arrangement. Printed cards from the Library of Congress are used, supplemented by typewritten cards for books reported as not in their stock. The library has been entirely re-catalogued on this plan in all subjects but one, and this is nearing completion.

The Reading Room is supplied with about 600 books of general reference which may be consulted by the students without any formality. All books with the exception of periodicals and books reserved for reference may be drawn for home use. The following current periodicals and newspapers are on file for the use of students and general readers in the Reading Room.

PERIODICAL LIST

- | | |
|---------------------------------------|---|
| *Advocate of Peace, | American Electro-Chemical Society, Transactions, |
| American Architect and Building News, | American Forestry, |
| American Blacksmith, | American Geographical Society, Bulletin, |
| American Chemical Journal, | American Historical Review, |
| American Chem. Society Journal, | American Institute of Mining Engineers, Transactions, |
| American College, | |
| *American Economist, | |

- American Journal of Pharmacy,
American Journal of Science,
American Journal of Sociology,
American Library Society Book-list,
American Machinist,
American Magazine,
American Mathematical Society, Bulletin,
American Mathematical Society, Transactions,
American Naturalist,
*American Philosophical Society, Proceedings,
American Society for Testing Materials, Proceedings,
American Society of Civil Engineers, Transactions,
Annalen der Physik,
Annales des Mines,
Architectural Record,
Archiv. f. d. Studium d. neueren Sprachen,
*Arizona Mining Journal,
Association of Engineering Societies, Journal,
Astrophysical Journal,
Athenaeum,
Atlantic Monthly,
Australian Mining Standard,
Biedermann's Zentralblatt fur Agrikulturchemie,
Book Review Digest,
*Bookbuyer,
Bookman,
Botanical Gazette,
Breder's Gazette,
Bulletin of Bibliography,
*California Cultivator,
*California University, Publications,
Canadian Entomologist,
Canadian Mining Journal,
*Canal Record,
Cassier's Magazine,
Cement,
Centralblatt f. Mineralogie,
Century,
Chemical, Metallurgical and Mining Society of South Africa, Journal,
Chemical News,
Chemical Society, Journal, (London),
Chemisches Centralblatt,
Collier's Weekly,
Country Life in America,
Craftsman,
Cumulative Book Index,
Current Literature,
Deutsche Chemische Gesellschaft, Berichte,
Dial,
Economic Geology,
*Educational Gazette,
Educational Review,
Electrical Review,
Electrical World,
Engineering and Mining Journal,
Engineering Index,
Engineering Magazine,
Engineering News,
Engineering Record,
Englische Studien,
Espana moderna, La.,
*Farmer's Voice,
Fern Bulletin,
Forum,
Franklin Institute, Journal,
Geological Magazine,
Geological Society of America, Bulletin,
Geologisches Centralblatt,

- Harper's Monthly Magazine,
Harper's Weekly,
Havana University, *Revista de la Facultad de letras y ciencias*,
Illustracion espanola y americana,
Independent (N. Y.),
Institut de France, Paris, Academie des Sciences, *Comptes rendus des Seances*,
International Studio,
Irrigation Age,
Journal of American Folk-lore,
Journal of Geography,
Journal of Geology,
Journal of Political Economy,
Ladies' Home Journal,
Library Work,
Life,
Literary Digest,
Living Age,
*Lowell Observatory, Bulletin,
McClure's Magazine,
Machinery,
Manual Training Magazine,
Metallurgical and Chemical Engineering,
Mexican Mining Journal,
Mineral Industry,
Mines and Methods,
Mines and Minerals,
Mining and Scientific Press,
Mining Magazine (London),
*Mining Reporter,
*Mining Review,
Mining Science,
*Mining World,
Missouri Ruralist,
Modern Language Association of America, Publications,
Modern Philology,
Monist,
- Musician,
Nation,
National Geographic Magazine,
Nature,
Neues Jahrbuch f. Mineralogie,
New York Dramatic Mirror,
Nineteenth Century and After,
North American Review,
*North German Lloyd Bulletin,
*Our Dumb Animals,
Out West,
Outing,
Outlook,
*Pacific Miner,
Pacific Monthly,
Philosophical Review,
Philosophical Magazine,
Physical Review,
Plant World,
Poet-Lore,
Political Science Quarterly,
Popular Astronomy,
Popular Science Monthly,
Power,
Practical Engineer,
*Prairie Farmer,
Public Libraries,
Publishers' Weekly,
Quarterly Journal of Economics,
Queensland Government Mining Journal,
Readers' Guide to Periodical Literature,
Review of Reviews,
Revue des deux Mondes,
School Review,
School of Mines Quarterly,
Science,
Scientific American,
Scientific American Supplement,
Scribner's Magazine,
Societe francaise de Mineralogie,
Bulletin,

Society for the Promotion of Engineering Education, Proceedings,
Society of Chemical Industry, Journal,
South African Mining Journal,
Spectator (London),
Sunset, System,
Technical World,
Torrey Botanical Club, Bulletin,

*Western Chemist and Metallurgist,
World's Work,
Zeitschrift f. analytische chemie,
Zeitschrift fur anorganische chemie,
Zeitschrift fur Elektrochemie,
Zeitschrift fur Krystallographie,
Zeitschrift fur physikalische chemie,

NEWSPAPERS ON FILE IN THE READING ROOM

*Arizona Blade,
*Arizona Bulletin,
Arizona Daily Star,
*Arizona Gazette,
Arizona Range News,
*Arizona Silver Belt,
Arizona Weekly Journal-Miner,
Bisbee Review,
Coconino Sun,
Los Angeles Times,

*Graham County Guardian,
Mojave County Miner,
*Oasis,
Prescott Weekly Courier,
Southwestern Stockmen,
*Tempe News,
Tucson Citizen,
Tucson Post,
Tombstone Epitaph,
Weekly Republican,

*Donated.

The Carnegie Library of the City of Tucson is also open to the use of the students of the University. This library also is a depository of United States Government documents.

Within the last calendar year our library has been enriched by two valuable donations. The first of these was a handsome collection of some 150 volumes on higher mathematics and physics, received from Dr. E. M. Blake; the second a gift from Dr. K. C. Babcock of 75 bound volumes and a large number of pamphlets relating chiefly to American history.

MUSEUM

The professors of the University have the immediate care of the collections pertaining to their respective departments. The collections now displayed at the University comprise representative series of minerals, ores and rocks of Arizona. Among these may be par-

ticularly mentioned superb specimens from the mines of the Copper Queen Mining Company at Bisbee. There are also collections of typical rocks and minerals for comparison, and many specimens of ores from different parts of the United States and from abroad. It is desired to make the collection of ores and minerals fully represent the great mineral resources of Arizona.

The Muesum is indebted to Mr. Herbert Brown, curator, for a large and valuable collection of skins of the birds of Arizona, which he has deposited in the Museum, as well as for a collection of ancient aboriginal pottery and other relics. The fossil skull and teeth of an elephant, and other fragmentary remains of extinct animals, sent from Yuma by Mr. Brown, deserve special mention.

Historical records of much value are gradually accumulating as a part of this museum, and an appeal is made to old settlers and others to bear this fact in mind when making disposition of articles bearing even remote relation to the early pioneers and their history. All records and data of any nature that can be gleaned are worthy of preservation, and it is earnestly desired to have them placed at the University, where they will always be accessible for reference.

AGRICULTURE AND HORTICULTURE

The University demonstration farm consists of eighty acres of Rillito Valley land. Thirty-two acres of this have been cleared; ten acres are seeded to alfalfa, five acres will be used for garden crops during the summer of 1911, and the balance will be seeded to alfalfa before September, 1911. An excellent well furnishes water for the farm, a number five Krough pump being run by a twelve horse power gasoline engine.

A farm residence has been constructed at a cost of about \$2,000, which is occupied by the farm foreman and his family. It contains an extra room which may be occupied by students in personal study of experiments.

The farm has recently constructed a horse barn with room for five horses and a work shop at a cost of about \$900; a modern sanitary dairy barn designed to furnish accommodations for 40 cows, at a cost of about \$1,600; a water tank with a capacity of 6000 gallons and

a distributing system for the whole ranch, at a cost of \$500. The main distributing ditch for irrigation purposes has been constructed out of cement tile at a cost of \$500, an improvement that will soon pay for itself in the saving of water otherwise lost by percolation and evaporation.

During the summer of 1911 a dairy herd of pure bred registered Guernseys will be purchased and also a full equipment for laboratory and farm dairy work.

An agronomy laboratory is well equipped with apparatus for teaching soil physics, and the green houses furnish accommodations for laboratory work in plant culture and other horticultural subjects. Laboratory facilities are also being provided for the use of classes in animal physiology. As soon as funds can be obtained for the purpose it is intended to provide full equipment for laboratory and demonstration work in poultry husbandry.

The section in the University library devoted to agriculture contains all the leading reference works in agriculture, including cyclopaedias, herd books, standard texts, and experiment station bulletins. The student is required to make much of his preparation for class room recitations by consulting the works in this library.

The laboratories of the Arizona Agricultural Experiment Station, located in the main building, together with its plant breeding and plant introduction gardens, located on the University campus, furnish abundant opportunity for students to observe the working out of experimental problems of vital interest to the agriculture of the Territory, while the campus itself, with its many ornamental trees, shrubs, and flowers, all of which are peculiarly adapted to the climate of the arid Southwest, furnishes excellent facilities for the study of problems of ornamentation and home building.

In addition to regular courses of instruction in agriculture and horticulture, "Timely Hints for Farmers," issued under the auspices of the Experiment Station, are of distinct educational value. Three thousand farmers of the Territory are reached more or less regularly by timely publications on subjects of vital interest. Farmers' Institutes, announcements of which are made from time to time, are supplemented by short courses in agriculture.

Small and well selected agricultural libraries of small cost have been forwarded to a considerable number who have expressed a willingness to receive them.

BIOLOGY

The biological laboratories are located on the third floor of Science Hall, in a fine suite of eight rooms, convenient and well-lighted for microscopic work; the equipment is such as is required for modern instruction and research in the biological sciences. The library and apparatus are well selected and adapted to the region and the courses offered.

The collections possessed by the department form a very important part of its equipment. The herbarium consists of 20,000 sheets of mounted plants, of which number 8000 are included in the University botanical survey herbarium. The unique flora and fauna of the mountain, mesa and lowland collecting grounds, in close proximity to the institution, offer very attractive opportunities for instruction and research especially along ecological lines. The Desert Botanical Laboratory of the Carnegie Institution supplements in most admirable fashion the facilities of the University for investigation.

In addition to the above there are fifty cases of insects, a large case of seeds, articulate and disarticulate human skeletons, plaster and papier mache models of the important structures of the human anatomy, and duplicate material for study and dissection.

During the past year several pieces of special apparatus were added to the equipment, including a Leitz rotary microtome, a large paraffin bath, a McIntosh stereopticon and photographic camera. Four new Leitz compound microscopes of the latest pattern were also purchased.

CHEMISTRY

The chemical laboratories used for instruction occupy twelve laboratories, class rooms, storerooms, etc., on the second and third floors of the new Science Hall.

The laboratory used by Freshmen for the study of general chemistry and qualitative analysis is at the east end of the second floor of Science Hall. It was newly furnished throughout during the current year,

with desks, hoods, racks, etc., and piped for both water and gas. It has accommodations for forty-eight students.

The laboratory for quantitative analysis is at the west end of the second floor of Science Hall. It is thoroughly equipped for the teaching of volumetric and gasometric analysis, and metallurgical chemistry, including apparatus for the electrolytic determination of metals. The balance room contains analytical balances of the latest models so arranged as to insure a maximum of stability and accuracy.

A lecture and demonstration room fitted with sinks, cabinets, etc., completes an equipment of apparatus and collections adequate for complete instruction in both theoretical and practical chemistry.

The laboratory of physical chemistry, located on the third floor of the Science Hall, is well equipped with the following apparatus: Wanner's Optical pyrometer, Chateliers pyrometer, boiling point and freezing point apparatus, Pulfrich refractometer, large wave length spectroscope made by Adam Hilper, London, thermostats, polariscope, and apparatus for conductivity work and the determination of electromotive force.

Two small laboratories on the third floor are to be equipped for electro-analysis and advanced work in chemistry.

The laboratories of the Agricultural Experiment Station occupy four rooms on the first floor of the Main Building. These are devoted to analytical work and chemical investigations relating to agriculture. Though not intended for the use of students they are of incidental value to the instructors and students through the investigations which are here conducted.

CIVIL ENGINEERING

The present quarters of this department are a recitation room, an instrument room and office, a materials testing laboratory, and a drafting room. The latter room occupies the entire east end of the third floor of Science Hall. The other rooms are in the Shop and Assay Building.

The instrument room contains lockers in which the surveying instruments are kept. These include six transits, three levels, two plane

tables, two compasses, a sextant, a considerable number of small instruments, and other equipment required for field work.

The materials testing laboratory is fitted for making physical tests of wood, iron, steel, stone, cement, concrete, and other materials used in engineering construction. The apparatus includes an Olsen 100,000 pound universal testing machine, a duplex micrometer extensometer, a Fairbanks cement testing machine, briquette molds, cube molds, molds for concrete beams, molds for specimens for testing shearing strength of concrete, a Vicat needle machine, specific gravity flasks, sieves, a moist chamber and other auxilliary equipment.

MECHANIC ARTS

The Shops and Drawing Rooms occupy a total floor area of about 8000 square feet, divided into a large shop and machinery room, with adjacent tool, supply and store rooms; draughting, model, pattern, lecture rooms and office.

The entire building is well ventilated and lighted from above as well as from the sides and is steam heated.

The wood shop is equipped with a full assortment of hand tools, twenty-four benches with a complete set of tools with each, six turning lathes, Beach scroll saw, a Whitney dimension sawing machine, a band saw, a Universal trimmer, and a large grindstone with truing device.

The forge-room contains twenty down-draught forges, twenty anvils, a combination shear and punch, a blacksmith's drill press and a full assortment of small tools and appliances. Blast is furnished by a No. 3 Sturtevant blower; the smoke and gases are removed by a 70-inch exhaust fan.

The machine shop contains one 24-inch Lodge and Shipley engine lathe with taper attachment, two 14-inch Lodge and Shipley lathes, one 14-inch Pratt and Whitney lathe with taper attachment, one 12-inch Seneca Falls lathe with taper attachment, drawing chuck, and English and Metric change gears; one 10-inch Reed speed lathe, one 16-inch Cincinnati shaper, one 24-inch by 6-foot Woodward and Powel planer, one Browne & Sharpe No. 2 Universal milling ma-

chine, one Browne & Sharpe No. 1 Universal grinder, one Prentice 24-inch drill press, one 13-inch Slate sensitive drill, one power hack saw, one drill grinder, one emery stand, one grinding attachment for lathes, one 1½ ton portable hoist, one 1-ton triplex hoist, one ½-ton screw hoist. Each shop has its own tool room well equipped with small tools, gauges, measuring instruments, etc.

MECHANICAL AND ELECTRICAL ENGINEERING

The offices of the department are in the instrument room of the Mechanical laboratory. In this room is the catalogue file containing the trade literature of about five hundred leading manufacturers of this country, together with a large collection of working drawings, and sample collection of models, machine parts, valves, electrical fittings, insulating materials, abrasives, etc.

The mechanical and electrical laboratory is equipped for experimental work in the study and operation of steam boilers, steam and gas engines, hydraulic and electrical machinery. Besides the machinery of the shop and mill which can be used for the study of machine design as well as for experimental work, the University has a 45 horsepower return tubular boiler, a 35 horsepower Atlas center crank engine, a 60 horsepower Chuse high speed automatic side crank engine, to be direct connected to generator, a 30 horsepower Fort Scott engine, a 10 x 7 x 10 Worthington duplex direct acting steam pump, a small duplex pump, a small Cameron boiler feed pump, an injector, a 40 horsepower Fairbanks Morse gasoline engine direct connected to a 500 gallon high pressure fire pump, a 23 k. w. Crocker Wheeler direct current generator, a 5 k. w. Fort Wayne rotary convertor, a 7 horsepower Westinghouse induction motor, a 3 horsepower and a ½ horsepower direct current motor. An 8" x 10" Gould triplex pump with its electric motor serve as part of the equipment of the mechanical-electrical laboratory as well as furnishing the University with its water supply. The department is well equipped with electrical measuring instruments, steam indicators, gauges, weighing scales, etc. For the testing of pumping machinery a large steel wier box overflowing into a cement cistern, is connected by suitable piping to the various pumps in the laboratory.

METALLURGY

The Mill, or metallurgical laboratory, is equipped for use by the students of metallurgy in connection with their work in testing ores as to their adaptability for treatment by different processes both on a large and a small scale.

The chief features of the equipment are: a Blake crusher, 4 in. by 7 in.; a Dodge crusher, 4 in. by 6 in.; sampling rolls, 6 in. by 9 in.; a cone and burr sample grinder; a pebble mill with a capacity of about 15 lbs. at one charge; a laboratory lightning crusher and a disc pulverizer; a 5-stamp mill, with 800-pound stamps; a 3-stamp mill, with 250-pound stamps; inside and outside amalgamated plates for the same; a 2-ft. clean-up pan; a 1-ft. amalgamation pan, and a 9-jar revolving agitator for testing samples of a few ounces; a No. 5 Wilfley table of the latest pattern, and a Hallett hand jig; a 1½ ton cyanide plant for treating sands or dry crushed ore; two 150-lb. cyanide plants for treating smaller samples; 3-ft. agitator; a 12-in., 6-chamber, flush plate and frame, washing filter press and pump for the same; a Sturtevant shaking screen; a Tullock ore feeder; a belt and bucket elevator, sampling plates, split samplers, a shaking screen, percolators, sizing screens from 1-mesh to 200-mesh, miners' pans, bateas, retorts, etc.

The power for operating this plant is furnished by a 30 h. p. Westinghouse induction motor, type C.

There has been recently added The Callow Miniature Plant, consisting of: 1 small two-compartment Harz jig, 1 small Wilfley table, 1 amalgamating plate, 1 set hydraulic classifiers, 1 set cyanide agitators, 1 automatic feeder. This plant is driven by a $\frac{1}{8}$ h. p. motor and stands on a hopper bottom tank divided into three compartments. It is a complete ore dressing plant, gold mill—and together with the cyanide percolators described elsewhere—cyanide mill, and tests quantities of ore ranging in amounts from 25 to 400 pounds. The results from these tests should truly predict the performance of a full size plant.

The assay laboratory is equipped with assay furnaces for crucible work, for scorifying and cupeling, and for retorting mercury from amalgam, fired with coke, gasoline and gas, so the student becomes

trained in the use of all these fuels. There are besides, all needed appliances for assaying by dry and wet method including electrolysis. The laboratory also has desks and fittings for the chemical work required in the metallurgical and mineralogical investigation and analysis of ores, in mineral fertilizers, and in qualitative tests of minerals.

MINERALOGY AND PETROGRAPHY

The laboratories for mineralogy consist of two rooms on the second floor of the Science Building, one being used for microscopic work in petrography and the other for blowpipe analysis and determinative mineralogy. The laboratory for microscopic work is equipped with seven petrographic microscopes including both American and foreign make, one Zeiss binocular for opaque work, models for illustrating axes of elasticity and spherical projection, a type set of rocks classified according to Rosenbusch's *Elemente der Gesteinlehre* with thin section corresponding, 120 oriented sections of minerals, and apparatus for photo-micrography and projection. The laboratory for blowpipe analysis is well supplied with minerals for making the necessary tests and studying the physical properties. A type set of 600 minerals classified according to Dana is included. For the study of crystallography, there is a collection of 300 pasteboard models of crystals, numerous glass and wooden models, three two-circle contact goniometers and one two-circle reflecting Goldschmidt goniometer of the most recent type, apparatus for the projection and drawing of crystals, and a model machine for cutting crystal models from plaster of Paris.

PHYSICS AND ASTRONOMY

The department of physics occupies the entire first floor of the new Science Hall, where the facilities for the demonstration of all important phenomena are very complete. A lecture room seating forty persons is fitted with every modern convenience, such as lights, water, gas, heliostat, alternating and direct currents of great range, an opaque projection lantern, elevated seats, shutters for darkening the room, etc. Two large main laboratory rooms supply space for mechanical and electrical work, while separate special rooms are devoted to heat, sound, light, magnetism and research work. A car-

penter's shop, a repair and store room, a photographic dark and enlarging room, and a constant temperature room are provided. A pendulum seismograph will be installed in the magnetic laboratory and a special space has been provided for a 55-foot Foucault pendulum and the study of falling bodies.

An eight-inch Willyoung induction coil with storage and X-ray accessories is used in the study of high-tension electricity. This has recently been supplemented by a large Oudin resonator and a mercury interrupter, manufactured by Cox, and a Tesla coil of the Elster and Geitel type. Through the generosity of the Honorable Mark J. Egan, of Clifton, the University added to its equipment for the study of electricity a fine imported set of miniature wireless telegraphy apparatus, capable of transmitting messages about two hundred feet. Also a Knott wireless outfit of $\frac{1}{4}$ -kilowatt power, capable of sending messages about twenty-five miles, is installed. The department is also equipped with three motor generator sets, the largest having an output of 7-kilowatts, with a Leeds and Northrup potentiometer and accessories, and with very complete apparatus for showing electromagnetic phenomena, rotary fields, stationary electric waves, etc.

The astronomical observatory is at the top of the building where a sliding roof, 12 feet square, uncovers the telescope and discloses a clear horizon in every direction. An 8-inch Clark lens and mounting, both of the first quality, loaned to the University by the Observatory of Harvard University, Cambridge, Mass., are mounted on a cement pier supported on the main walls of the building, and give perfectly steady images. This lens is most efficient in fundamental research work. The equipment also includes a four and one-quarter inch Brashear telescope, siderial and mean time clocks and pier for latitude and longitude observation.

GYMNASIUM

Herring Hall, the gymnasium, is fully equipped for the purposes of the department of physical training and athletics. The apparatus is of standard make, and includes forty chestweights, dumb-bells, bar-bells, wands, Indian clubs, Medart vaulting horse, parallel bars, horizontal bar, quarter-circle, abdominal chair, wrestling machine, finger

machine, chest expander, chest developer, climbing rope, flying rings, traveling rings, striking bag and drum, jump and vaulting stands, fencing foils and masks, basket balls and goals, five large mats and a set of anthropometric apparatus.

In the basement are located ninety-six lockers, and five shower baths which are supplied with hot water from a heater with large reservoir.

The outdoor equipment consists of two baseball fields; a football field, six-lap track, and straightaway, at the rear of the gymnasium; five fine tennis courts; and a basketball court for girls.

MILITARY

Room O, in University Hall, is used as an armory. It is fitted up with the necessary gun racks and accessories. The equipment includes 150 old style Springfield rifles, 100 Krag cadet rifles with complete accoutrements, 4 model 1906 Springfield chambered for .22 for indoor practice, eight sabres and belts, musical instruments for the band, and signal flags. A large clear area south of the Library building is kept leveled and smooth for a drill ground and parade ground. At the rear of the Mill building are the targets for short range practice.

Fifteen 10 x 12 army wall tents with poles, etc., and a mess outfit, constitute the camp equipment of the department of military science and tactics for use on practice marches and annual encampments.

GENERAL INFORMATION

COLLEGE OF AGRICULTURE AND MECHANIC ARTS

The courses offered in the College of Agriculture and the Mechanic Arts provide both a liberal training along literary and scientific lines and technical training along engineering, mechanical and agricultural lines. Great latitude of election is given in the literary and scientific courses, but the courses in engineering are more rigid in their requirements. Full details of the various courses follow. The aim in all is to combine the practical with the theoretical instruction. The needs of a young and growing commonwealth are kept in mind, and a steady attempt is made to develop the adaptability and resourcefulness so necessary to meet changing conditions.

ARIZONA SCHOOL OF MINES

The School of Mines is designed for the education and training of young men in the arts and sciences directly involved in the industries of mining and metallurgy. Especial attention is given to the sciences of mathematics, physics, chemistry, mineralogy, geology and their applications. The Bureau of Mines and Assaying, while not directly connected with the work of instruction, affords with its laboratory and the influx of new material, a valuable object lesson to the advanced students of mining and metallurgy.

REGISTRATION

All students are expected to register on registration day at the beginning of the year and at the beginning of the second semester, in the University office or in such rooms as may be designated on that day. Before making choice of elective subjects the student should in every case confer with the instructors concerned and with the committee on registration. All students are required to pay an annual incidental fee of \$5.00 at the time of registration, and no student will be considered registered and entitled to attend classes unless this fee has been paid. After registration no change in classes can be made without the consent of the committee on registration or the President.

Students entering from other institutions should present to the committee certified copies of their records in such schools, together with certificates of graduation or of honorable dismissal. A copy of the school catalogue or course of study should be furnished with the credentials, in order to facilitate the work of the committee.

RECORDS

The class standing of each student is determined by the instructor in charge. The method of ascertaining the student's record is left to the instructor, and his report in all cases is final. In addition to the reports at the end of each semester, which form the permanent records of each student, each instructor makes a monthly provisional report to the office on all students registered in his courses, and a card showing the standing of each student is mailed to his parents or guardian every month.

DISCIPLINE

The disciplinary policy of the University in all its departments is based upon the assumption that the students are young gentlemen and young ladies who come to the institution with a high determination to utilize fully the opportunities offered, and with a keen sense of duty, honor and courtesy to each other and to the faculty.

Students or classes desiring to make requests of the faculty should file their petition in the President's office before the hour of faculty meeting; class petitions must be presented at least two days before the time of meeting.

VACATIONS AND HOLIDAYS

A short recess (see Calendar, page 2) is taken at Christmas time. The long summer vacation begins about June first and continues until the middle of September. The Thanksgiving recess extends from the close of the regular exercises on the Wednesday before Thanksgiving to the next Monday morning. During the spring, the cadet companies make a practice march of from three to seven days, which constitutes in reality a third vacation. All legal holidays are observed by the cessation of ordinary University work.

Arbor day has been formally adopted by the University Regents as the regular anniversary on which to celebrate the founding of the institution, in connection with the ceremonies of tree planting.

LIVING ACCOMMODATIONS

Provision is made so far as possible for furnishing board and rooms to students of both sexes upon the University grounds. Young men have comfortable quarters in South Hall, which can accommodate about seventy-five students, two in a room, and in North Hall (for College men only), which can accommodate thirty-five students. Two other halls provide accommodations for young women, under the direction of a capable and experienced preceptress.

All dormitories are lighted by electricity; South Hall is heated by a hot water system, the other dormitories being heated by stoves. Rooms contain a clothes press, and are provided with single bedsteads, tables, chairs, mirror, wash bowl, pitcher, and slop jar. Stu-

dents will supply their own mattresses, pillows, sheets, blankets, towels, rugs, and brooms, and such other articles as they may desire for ornamenting their rooms. They will care for their own rooms under the direction of the head of each dormitory.

The Dining Hall of the University has accommodations for one hundred students. It is under the management of a paid steward who is responsible to the President and the Board of Regents. While the charge of \$18 per month for board is very low, it is the aim of the management to serve substantial, wholesome, appetizing meals. All students having rooms in the dormitories are required to take their meals at the Dining Hall. Students and members of the faculty who reside outside the dormitories, may board at the Dining Hall.

By resolution of the Board of Regents of the University, board is to be paid in advance on the twelfth of each month. If payment is not made before the fifteenth of each month, \$19.00 instead of \$18.00 will be charged for the month's board. Checks and postoffice or express money orders should be made payable to the President. No reduction in the bill for board will be made for a period less than one week, except by special arrangement at the office, made in advance.

TUITION

Tuition is free to students of Arizona. For all non-resident students, tuition is \$10 for each semester. No reduction will be made for late registration or early withdrawal.

FEES AND EXPENSES

	LOW	HIGH
Tuition free to students from Arizona.....		
Tuition, students non-residents of Arizona, each semester	\$10.00	\$10.00
Incidental fee, paid annually.....	5.00	5.00
Mining excursions for advanced students.....	20.00	40.00
Military uniform, cadet gray.....	16.25	24.00
Military uniform, khaki.....	7.25	10.00
Books, a year.....	5.00	20.00
Board, a month.....	18.00	20.00
Lights per room, a month.....	.50	1.50

LABORATORY FEES

Assaying. See Metallurgy 2.	
Botany, 1, 2, 3, 4, each.....	\$ 2.50
Chemistry 1, 2, each.....	15.00
Chemistry 3, 4, 5, 6, 7, each.....	15.00
Chemistry 10.....	5.00
Chemistry III (Preparatory year).....	12.00
Civil Engineering 3, 11, 13, 15, 18, 20, each.....	1.00
Civil Engineering 1, 2, 6, 7, 8, 17, 19, each.....	1.50
Civil Engineering 14.....	2.00
Geology 5, 6 (year).....	10.00
Mechanic Arts I, II, 1, 2 (each year).....	5.00
Metallurgy 2, (Assaying).....	25.00
Metallurgy 5A, 5B, 6, each.....	6.00
Mineralogy 1, 2, (year).....	15.00
Mineralogy 3, 4, (year).....	5.00
Physics 1, 2, (year).....	2.00
Physics 3, 4, 5.....	2.00
Physics IV, (year).....	2.00

Text-books may be obtained directly from the publishers through a book association managed on the co-operative plan under the direction of the faculty.

Members of the cadet companies will be required to provide themselves with the prescribed uniform, which will be ordered by the University. The cost of the cadet grey, woolen uniform, is \$16.25. The uniform has shown better wearing qualities than a civilian suit of equal cost, and parents are urged to consider the matter of uniform when supplying their sons with clothing for the approaching University year. It may be worn on all occasions, and thus will remove the necessity for additional expenditure for outer clothing other than overcoats. When the warm weather of spring comes, the students are expected to purchase the regulation khaki uniform and campaign hat, the total expense being about \$7.25.

ASSISTANCE TO STUDENTS

The University has at present no loan funds with which to aid

students who must earn their way. Various positions about the grounds, buildings and laboratories of the University, paying from \$4 to \$20 per month, are filled by students who must be self-supporting. The number, however, is not large, and preference is given to students from Arizona and to those who have spent time enough in the University to demonstrate that they are earnest, capable, reliable young men, likely to do this outside work and at the same time maintain a good record as students. During the academic year of 1909-1910 forty-two different students were given assistance, totaling \$2,700, or an average of \$64.

The Philo Sherman Bennett scholarship, the income of \$500, for aiding young women to secure an education, is regularly awarded to deserving students.

REQUIREMENTS FOR ADMISSION

Applicants for admission to any department of the University will be required to furnish satisfactory evidence of good moral character, and certificate of graduation or of honorable dismissal from the schools with which they were last connected.

For admission to the Freshman class applicants must be at least sixteen years of age and must satisfy requirements in subjects sufficient to give fifteen credits as described below. A credit is understood to be the equivalent of one study pursued satisfactorily at least four times a week for one year, as ordinarily taught in high schools.

Students coming from approved high schools and preparatory schools, and presenting a detailed official statement of work completed from the principals of such schools, will be excused by the committee on registration from entrance examinations in those subjects covered by the credentials, with the exception of English composition. Other students will be required to pass the entrance examinations.

For admission to the course leading to the degree of Bachelor of Arts or Bachelor of Science, the subjects and credits assigned each are:

English	3	Science	1
Algebra	1½	Latin	2
Plane Geometry	1	Greek, French, German or	
History and Civics.....	1	Spanish	2
		Elective	2

For admission to the course leading to the degree of Bachelor of Science in Mining Engineering, Civil Engineering, Mechanical Engineering, or Metallurgy, the subjects and credits assigned each are:

Any student having had Trigonometry, where such credit has not been used for entrance, may waive a credit of two units in the college department upon passing a satisfactory examination in that subject.

English	3	Latin, French, German or	
Algebra	1½	Spanish	2
Plane Geometry	1	Physics and Chemistry.....	1
Solid Geometry	½	Elective	6
History and Civics.....	1		

For entrance to the course in Mining Engineering applicants must have both Physics and Chemistry. This leaves but 5 electives for such students.

SCOPE OF THE ADMISSION REQUIREMENTS

ENGLISH

English—4 credits. (a) English classics. An acquaintance with the works named below. These works are divided into two classes, those intended for thorough study and those intended for general reading. The portion of the examination devoted to the former class will be upon subject matter, form and structure. In addition the candidate may be required to answer questions concerning the leading facts in those periods of English literary history to which the prescribed books belong. In the portion of the examination devoted to the latter class, the candidate will be required to present evidence of a general knowledge of the subject matter, and to answer simple questions on the lives of the authors. The form of the examination will usually be the writing of a paragraph or two on each of several topics, to be chosen by the candidate from a considerable number—perhaps ten or fifteen—set before him in the examination paper. (b) English

Composition. The examination will take the form of a theme of five hundred words on some subject familiar to the candidate and will be a practical test of his ability to express himself in writing clearly and consecutively. No candidate will be accepted whose work is notably defective in point of neatness, spelling, punctuation, idiom, or division into paragraphs. Those found lacking in composition will be required to make good the deficiency at once in a special class organized for that purpose.

No student will be admitted without examination, except on the certificate from his former instructors that the entire requirement has been fulfilled. Substantial equivalents, properly certified, will be accepted.

For thorough study, for 1911: Shakespeare's *Macbeth*, Milton's *Lycidas*, *Comus*, *L'Allegro* and *Il Penseroso*; Burke's *Speech on Conciliation with America* or Washington's *Farewell Address* and Webster's *First Bunker Hill Oration*; Macaulay's *Life of Johnson* or Carlyle's *Essay on Burns*.

For general reading and practice, selections will be made, at the discretion of the teacher from groups I-VI of College Entrance Requirements in English for 1910-1911.

MATHEMATICS

Algebra— $1\frac{1}{2}$ credits. The work required in Algebra covers the usual fundamental subjects, and extends through quadratic equations, graphical representation of equations, proportion, etc., as given in Wells' Essentials of Algebra, or Wentworth's High School Algebra.

Plane Geometry—1 credit. A year is devoted to the subject. The course is based upon the work outlined in Robbins' or Wentworth's Geometry, with special reference to original exercises and notebook work.

Solid Geometry— $\frac{1}{2}$ credit. A half year is given to this subject. Original exercises and notebook work are required.

HISTORY

To meet the requirement in history the student will be expected to have used, in preparation for each credit, a good textbook, to have done regular reference work, and to have kept a notebook with out-

lines, summaries, maps, and topical notes on readings, varying in proportion, according to the advancement of the course.

Ancient History—to the year 800 A. D. 1 credit.

Mediaeval and Modern History of Europe—1 credit.

History of England—1 credit.

History and Government of the United States—1 credit.

LANGUAGE

**Greek*—2 credits. As covered by Gleason and Atherton's *Beginner's Greek Book*; Xenophon's *Anabasis*, four books; Homer's *Iliad*, three books, with composition and the use of Hadley and Allen's or Goodwin's *Greek Grammar*.

**Latin*—2, 3 or 4 credits. As covered by Collar's *First Latin Book* and *Viri Romae*, together with Allen and Greenough's *Grammar* and texts; sight reading; *Caesar*, four books, or an equivalent; Cicero, four orations; Virgil, six books; sight reading from Nepos, Cicero and Gellius; Daniell's or Bennett's *Prose Composition*.

German—2 credits. First year: Bacon, *German Grammar*; Storm, *Immensee*; von Hillern, *Hoher als die Kirche*; other readings. Second year: German Composition; Meyer-Foerster, *Karl Heinrich*; Heine, Poems and *Die Harzreise*; Lessing, *Minna von Barnhelm*; Schiller, *William Tell*.

**French*—2 credits. First year: Frazer and Squair, *French Grammar* (Part I); Aldrich and Foster, *French Reader*; Labiche and Martin, *La Poudre aux yeux*; Halvey, *L'Abbé Constantin*. Second year: *Grammar* (Part II); Merimée, *Colomba*; Lamartine, *Graziella*; Sand, *La Mare au Diable*; Canfield, *French Lyrics*; Victor Hugo, *Les Misérables* (abridged).

**Spanish*—2 credits. First year: Hill and Ford, *Spanish Grammar*; Worman, *First Spanish Book*; Turrell, *Spanish Reader*. Second year: Johnson, *Cuentos modernos*; Alarcon, *El Capitan veneno*; Galdos, *Marianela*; Valdes, *La Alegría del Capitan Ribot*; Umphrey, *Spanish Composition*.

*The courses offered should include the texts outlined, or an equivalent. Two years of one language must be presented, but one or more years of a second language will be accepted as elective.

SCIENCE

Physical Geography—1 credit or $\frac{1}{2}$ credit. A year or half year of work which should include the principles of the subject, as treated in the best recent textbooks, field and laboratory study, and the interpretation and steady use of topographic and weather maps, charts, etc. This subject may be combined in half-credits with botany, zoology, or physiology, which may in their turn be offered as full credits if it is so desired.

Botany—1 credit or $\frac{1}{2}$ credit. The course should cover a study of the life histories of types from the main groups of plants, and a series of simple physiological experiments. At least two-thirds of the course should consist of laboratory work.

Chemistry—1 credit. A year's course of descriptive chemistry, consisting of both class-room and laboratory work, which should include the more common metals and non-metals and their compounds. A careful record of laboratory experiments should be kept.

Physics—1 credit. Along with the use of one of the standard textbooks the year's course should include continuous and systematic laboratory practice, which should be recorded in a notebook.

ELECTIVES

The electives offered for admission should be chosen from the above subjects or any other subjects ordinarily taught in high schools and accepted by reputable colleges and universities.

ADMISSION TO ADVANCED STANDING

Students coming from other institutions of recognized standing may be admitted to classes above Freshman upon the presentation of properly authenticated certificates of work done, and when so admitted will be credited upon the records of this University with so much of such work as corresponds approximately with the courses required for the desired degree here. Certificates of record should be accompanied by statements of honorable dismissal or leave of absence, and a copy of the register or catalogue showing the content of the credits certified.

ADMISSION FROM ARIZONA NORMAL SCHOOLS

By arrangements with the Arizona Normal School at Tempe, and the Northern Normal School at Flagstaff, students from these institutions will be received into the University without examination, and given credit for all work which is the equivalent of courses offered by the University either for admission or for a degree. Students from this University may also obtain the equivalent privilege at the Normal Schools by presenting the proper certificate of standing, signed by the President.

ADMISSION UPON CERTIFICATE

Since the statutes of Arizona provide the course of study in the high schools of the Territory "shall be such as, when completed, shall prepare its students for admission into the Territorial University," the University admits without examination, save in English composition, graduates of approved high schools of Arizona. Diplomas or corresponding credentials from high schools and preparatory schools in other states, accredited by the state universities of such states, will excuse from examinations in subjects covered by such credentials, save in English composition.

Accredited four-years high schools in Arizona:

Bisbee,	Phoenix,
Clifton,	Prescott,
Douglas,	Tempe,
Globe,	Tucson,
Mesa,	Yuma.

High schools which have not in operation the full four-year course:

Tombstone, Willcox.

Credits are accepted also from the Thatcher Latter Day Saints' Academy.

COURSE OF STUDY AND DEGREES

All facilities and privileges of the University are open to qualified persons of both sexes.

The University offers four-year courses of study leading to the degree of Bachelor of Arts and Bachelor of Science, and to those de-

grees specialized as shown on pages 43-53. In each course the work is partly required and partly elective, as described by schedules later. Each student doing full work is required to take not less than fifteen hours of class room work per week. In laboratory work a period of from two to three hours is considered the equivalent of one recitation or lecture hour.

Persons of mature age and with sufficient preparation, who are not candidates for degrees, may be admitted to regular classes as special students, provided, however, that in all such cases they show to the satisfaction of the instructors in charge that they can take the course with profit to themselves and without detriment to the regular class. It is expected that those who desire thus to specialize in mineralogy, assaying, geology or surveying, will have had at least a high school education, or its equivalent, particularly in English, algebra, geometry, physics and chemistry.

The faculty reserves the right to omit classes in any course of instruction unless a suitable number of students register for the course.

Students who complete satisfactorily the required work, and the specified amount of elective work, as shown in the accompanying schedules, will be given the degrees of Bachelor of Arts or Bachelor of Science. The special character of any course of study is indicated by adding to the degree the name of the department, as Bachelor of Science in Mining Engineering.

Military science and tactics and physical training are required during the freshman and sophomore years for all male students, and physical training for female students. If for any reason a student is excused from these exercises, an additional subject having a minimum of three recitation hours per week will be required.

Credit toward degrees is given by means of a unit system which assigns to each course of instruction offered a certain number of units of credits. A unit ordinarily represents one class-room hour per week, or its equivalent of two or three laboratory hours, for one semester. One hundred and thirty-one units, including three units

*Before registering for electives the student must present to the registration committee, the recommendation of the President or the head of the department concerning the courses selected.

in military science and tactics and physical culture, are required for obtaining the degree of Bachelor of Arts and Bachelor of Science. The requirements for degrees in the specialized courses are given on pages 43 to 53.

Any candidate for a degree may present as part fulfilment of requirements for graduation an acceptable thesis embodying the result of a special study of some subject within the range of the course pursued. The subject of the thesis must be submitted for the approval of the faculty at the opening of the senior year, and the completed thesis must be presented not later than three weeks before Commencement Day. The credit value will be determined by the faculty at the time the subject is approved.

GROUPS OF SUBJECTS

GENERAL:

English, Philosophy, Mathematics, Military Science, Physical Training.

GROUP A:

Latin, Greek, French, German, Spanish.

GROUP B:

Economics, History, Law, Sociology.

GROUP C:

Agriculture, Astronomy, Botany, Chemistry, Geology, Mineralogy, Physics, Zoology.

GROUP D:

Civil Engineering, Electrical Engineering, Mechanic Arts, Mechanical Engineering, Metallurgy, Mining Engineering.

REQUIREMENTS FOR DEGREES

The units necessary for the different degrees are set forth in the following tabulations:

	Required	Free elective
BACHELOR OF ARTS:		29
English	24	
Philosophy	12	
Mil. Science, Physical Training.....	3	
Group A	32	

Group B	15
Group C	16
Total, 131 units.	

BACHELOR OF SCIENCE: 44

English	10
Mathematics	10
French or German	16
Mil. Science, Physical Training.....	3
Group B	8
Group C and D	40

Total, 131 units.

COURSE I**Leading to the Degree of Bachelor of Science in Agriculture
(Agronomy-Horticulture Options)****I YEAR**

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2.....	3
Math. 1a (Algebra)	3	Math. 2 (Analytic Geome-	
Math. 1b (Trigonometry) .	2	try)	5
Mech. Arts 1 (Mech. Draw-		Mech. Arts 8 (Carpentry) .	2
ing)	2	Agr. 4 (Dairying).....	3
Agr. 3 (Stock Judging)...	3	Agr. 2 (Farm Crops).....	3
Agr. 1 (Plant Culture)....	3	Mil. Sci.....	½
Mil. Sci.....	½	Phy. Tr.....	¼
Phy. Tr.....	¼		
			<u>16¾</u>
	<u>16¾</u>		

II YEAR

Physics 1	4	Physics 2.....	4
Chemistry III.....	4	Chemistry III.....	4
Botany I.....	4	Botany III.....	4
Mech. Arts 9 (Forge and		Mech. Eng. 14 (Small Pow-	
Metals)	2	er Plants and Machinery) 2	
Agr. 5 (Market Gardening)		Agr. 6 (Plant Breeding) ...	3
or Agr. 7 (Cereals).....	3	Mil. Sci.....	½
Mil. Sci.....	½	Phy. Tr.....	¼
Phy. Tr.....	¼		
			<u>17¾</u>
	<u>17¾</u>		

III YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Agr. 9 (Soil Physics)	4	Agr. 10 (Soil Fertility)	4
Civ. Eng. 19 (Surveying)	3	Civ. Eng. 20 (Irrigation)	3
Agr. 11 (Veterinary Physiology)	3	Agr. 12 (Animal Diseases)	3
Chemistry 1 or Agr. 13 (Pomology)	4	Chemistry 2 or Agr. 14 (Citrus Fruits)	4
Elective*	3	Elective*	3
	—		—
	17		17

IV YEAR

Chem. 3 (Quantitative Analysis)	4	Chem. 4 (Volumetric Analysis)	4
Or Botany 11 (Plant Pathology)	3	Or Botany 12 (Plant Pathology)	3
Agr. 25 (Agronomy Literature) or Agr. 19 (Small Fruits)	3	Agr. 20 (Horticultural Literature) or Elective	3
Economics 1	3	Agr. 26 (Farm Management)	3
Elective*	6	Economics 2	3
	—	Elective*	3
	15 or 16		—
Total, 133 or 135 units.			15 or 16

COURSE II

Leading to the Degree of Bachelor of Science in Agriculture
(Animal Husbandry—Dairy Options)

I YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	3
Math. 1a (Algebra)	3	Math. 2 (Analytic Geometry)	5
Math. 1b (Trigonometry)	2	Mech. Arts 8 (Carpentry)	2
Mech. Arts 1 (Mech. Drawing)	2	Agr. 4 (Dairying)	3
Agr. 3 (Stock Judging)	3	Agr. 2 (Farm Crops)	3
Agr. 1 (Plant Culture)	3	Mil. Sci.	$\frac{1}{2}$
Mil. Sci.	$\frac{1}{2}$	Phy. Tr.	$\frac{1}{4}$
Phy. Tr.	$\frac{1}{4}$		
	—		—
	17 $\frac{3}{4}$		17 $\frac{3}{4}$

*See footnote, page 41.

II YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Physics 1	4	Physics 2	4
Chemistry III	4	Chemistry III	4
Zoology 1	4	Zoology 2	4
Mech. Arts 9 (Forge and Metals)	2	Mech. Eng. 14 (Small Pow- er Plants and Machinery) 2	
Agr. 11 (Veterinary Physi- ology)	3	Agr. 12 (Animal Diseases) 3	
Mil. Sci.	½	Mil. Sci.	½
Phy. Tr.	¼	Phy. Tr.	¼
			17¾
	17¾		17¾

III YEAR

Agr. 15 (Poultry)	3	Agr. 16 (History of Breeds) 3
Civ. Eng. 19 (Surveying) . 3		Civ. Eng. 20 (Irrigation) . 3
Agr. 9 (Soil Physics) 4		Agr. 10 (Soil Fertility) ... 4
Agr. 17 (Animal Breeding) 3		Agr. 18 (Feeds and Feeding) 3
Botany 1 4		Agr. 8 (Milk Production) . 3
	17	16

IV YEAR

Agr. 21 (Advanced Stock Judging)	3	Agr. 22 (Live Stock Investi- gation)	3
Agr. 23 (Meat Production) 3		Agr. 24 (Animal Husbandry Literature)	3
Economics 1 3		Economics 2	3
Elective* 6		Agr. 26 (Farm Manage- ment)	3
	15	Elective*	4

Total, 135 units.

METALLURGY 16

(See Mining Engineering, p. 54, for First and Second Years)

III YEAR	UNITS	IV YEAR	UNITS
Math. 5, 6..... 9		Metal. 1, 3, 4, 5, 7, 9..... 13	
Mineral 1, 2 7		Min. Eng. 1, 2 4	
Geol. 1, 2 8		Civ. Eng. 14 4	
Chem. 5, 6 8		Geol. 3 3	
	32	Mech. Eng. 1, 2 6	
			30

*See footnote, page 41.

COURSE III

Leading to the Degree of Bachelor of Science in Civil Engineering

I YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	3
Math. 1a (Algebra).....	3	Math. 2 (Analytic Geom- etry)	5
Math. 1b (Trigonometry) .	2	*Chemistry 2	4
*Chemistry 1	4	Mech. Arts 2 (Descriptive Geometry)	3
Mech. Arts 1 (Mech. Drawing)	2	Mech. Arts 4 (Forge Shop) 2	
Mech. Arts 3 (Wood Shop)	2	Mil. Sci.	½
Mil. Sci.	½	Phy. Tr.	¼
	16¾		17¾

II YEAR

Math. 3 (Differential Cal- culus)	4	Math. 4 (Integral Calculus) 4	
Physics 1	4	Physics 2	4
Mech. Arts 5 (Machine Shop)	2	Mech. Arts 6 (Machine Shop)	2
Civ. Eng. 1 (Surveying) ..	4	Civ. Eng. 2 (Surveying) ..	4
Elective†	3	Elective†	3
Mil. Sci.	½	Mil. Sci.	½
Phy. Tr.	¼	Phy. Tr.	¼
	17¾		17¾

III YEAR

Math. 5 (Analytical Me- chanics)	5	Math. 6 (Analytical Me- chanics)
Astronomy 3	3	Physics 4 (Electrical and Optical Measurements) ..
Mineral 1 (Blow-Pipe An- alysis)	2	Civ. Eng. 14a (Mechanics of Materials)
Civ. Eng. 11 (Hydraulics) 4		

*Students who have not had preparatory or high school chemistry must take, in place of Chemistry, 1, 2, Chemistry III, for which college credit will be given. In this case Mineralogy 1 can not be taken in the third year unless Chemistry 1, 2, is elected in the second year.

III YEAR—CONTINUED

FIRST SEMESTER		UNITS	SECOND SEMESTER		UNITS
Civ. Eng. 9 (R. R. Surveying)	2		Civ. Eng. 14b (Materials Laboratory)	1	
		—	Civ. Eng. 10 (R. R. Surveying)	2	
	16		Elective†	3	
					—
			IV YEAR		16
Mech. Eng. 3 (Heat Engines)	3		Mech. Eng. 4 (Pumping Machinery)	3	
Civ. Eng. 7 (Steel Mill Buildings)	4		Civ. Eng. 6 (Masonry and Concrete)	4	
Civ. Eng. 13 (Irrigation)	4		Civ. Eng. 8 (Steel Bridges)	4	
Civ. Eng. 15 (Contracts, Specifications)	2		Civ. Eng. 18 (Sewerage)	3	
Civ. Eng. 17 (Water Supplies)	3		Elective†	2	
					—
Total, 134 units.		16			16

COURSE IV

Leading to the Degree of Bachelor of Science in Electrical Engineering

I YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	3
Math 1a (Algebra).....	3	Math. 2 (Analytic Geom- etry)	5
Math. 1b (Trigonometry) .	2	*Chemistry 2	4
*Chemistry 1	4	Mech. Arts 2 (Descriptive Geometry)	2
Mech. Arts 1 (Mech. Drawing)	2	Mech. Arts 4 (Forge Shop)	2
Mech. Arts 3 (Wood Shop)	2	Mil. Sci.	½
Mil. Sci.	½	Phy. Tr.	¼
Phy. Tr.	¼		
	—		—
	163½		173½

[†]See footnote, page 41.

*Students who have not had preparatory or high school chemistry must take, in place of Chemistry, 1, 2, Chemistry III, for which college credit will be given.

II YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Math. 3 (Differential Calculus)	4	Math. 4 (Integral Calculus)	4
Physics 1	4	Physics 2	4
Mech. Arts 5 (Machine Shop)	2	Mech. Arts 6 (Machine Shop)	2
Mech. Eng. 1 (Mechanisms)	2	Mec. Eng. 2 (Machine Design)	2
Civ. Eng. 1 (Surveying)	4	Elective†	5
Met. 1 (Iron and Steel)	1	Mil. Sci.	½
Mil. Sci.	½	Phy. Tr.	¼
Phy. Tr.	¼		
			17¾

III YEAR

Math. 5 (Analytical Mechanics)	5	Math. 6 (Analytical Mechanics)	4
Mech. Eng. 3 (Heat Engines)	3	Mech. Eng. 4 (Pumping Machinery)	3
Mech. Eng. 5 (Machine Design)	2	Mech. Eng. 6 (Machine Design)	2
Elec. Eng. 1 (Elements Elec. Eng.)	2	Elec. Eng. 2 (Dynamo-Elec. Machinery)	3
Civ. Eng. 11 (Hydraulics)	4	Civ. Eng. 14a (Mechanics of Materials)	3
	16	Civ. Eng. 14b (Materials Laboratory)	1
		Elec. Eng. 10 (Seminary)	1
			17

IV YEAR

Mech. Eng. 7 (Mechanical Laboratory)	1	Mech. Eng. 8 (Mechanical Laboratory)	1
Elec. Eng. 3 (Electrical Machinery)	2	Elec. Eng. 4 (Electric Traction)	2
Elec. Eng. 5 (Electrical Laboratory)	2	Elec. Eng. 6 (Electrical Laboratory)	2
Elec. Eng. 7 (Electrical Design)	2	Elec. Eng. 8 (Elec. Power Plant Design)	2

IV YEAR—CONTINUED

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Elective†	8	Mech. Eng. 12 (Power Sta-	
		tions)	2
	15	Elective†	4
Total, 132 units.			13

COURSE V

Leading to the Degree of Bachelor of Science in Mechanical Engineering

I YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	3
Math. 1a (Algebra)	3	Math. 2 (Analytic Geom-	
Math. 1b (Trigonometry) ..	2	etry)	5
*Chemistry 1	4	*Chemistry 2	4
Mech. Arts 1 (Mech. Drawing)	2	Mech. Arts 2 (Descriptive Geometry)	3
Mech. Arts 3 (Wood Shop) ..	2	Mech. Arts 4 (Forge Shop) ..	2
Mil. Sci.	½	Mil. Sci.	½
Phy. Tr.	¼	Phy. Tr.	¼
	16¾		17¾

II YEAR

Math. 3 (Differential Calculus)	4	Math. 4 (Integral Calculus) ..	4
Physics 1	4	Physics 2	4
Mech. Arts 5 (Machine Shop)	2	Mech. Arts 6 (Machine Shop)	2
Mech. Eng. 1 (Mechanisms)	2	Mech. Eng. 2 (Machine Design)	2
Civ. Eng. 1 (Surveying) ..	4	Elective†	5
Met. 1 (Iron and Steel) ..	1	Mil. Sci.	½
Mil. Sci.	½	Phy. Tr.	¼
Phy. Tr.	¼		17¾
	17¾		

†See footnote, page 41.

*Students who have not had preparatory or high school chemistry must take, in place of Chemistry 1, 2, Chemistry III, for which college credit will be given.

III YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Math. 5 (Analytical Mechanics)	5	Math. 6 (Analytical Mechanics)	4
Mech. Eng. 3 (Heat Engines)	3	Mech. Eng. 4 (Pumping Machinery)	3
Mech. Eng. 5 (Machine Design)	2	Mech. Eng. 6 (Machine Design)	2
Elec. Eng. 1 (Elements Elec. Eng.)	2	Elec. Eng. 2 (Dynamo-Elec. Machinery)	3
Civ. Eng. 11 (Hydraulics) 4		Civ. Eng. 14a (Mechanics of Materials)	3
	<hr/> 16	Civ. Eng. 14b (Materials Laboratory)	1
		Mech. Eng. 16 (Seminary) 1	

IV YEAR

Mech. Eng. 7 (Mechanical Laboratory)	3	Mech. Eng. 8 (Mechanical Laboratory)	3
Mech. Eng. 9 (Design) ... 2		Mech. Eng. 10 (Design) ... 2	
Civ. Eng. 7 (Steel Mill Buildings)	4	Mech. Eng. 12 (Power Stations)	2
Elective† 6		Elective† 6	

Total, 131 units.

15

13

COURSE VI

Leading to the Degree of Bachelor of Science in Metallurgy

I YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	3
Math. 1a (Algebra)..... 3		Math. (Analytic Geometry) 5	
Math. 1b (Trigonometry). 2		Chemistry 2	4
Chemistry 1	4	Mech. Arts 2 (Descriptive Geometry)	3
Mech. Arts 1 (Mech. Drawing)	2	Mech. Arts 4 (Forge Shop) 2	
Mech. Arts 3 (Wood Shop)	2	Mil. Sci.	$\frac{1}{2}$
Mil. Sci.	$\frac{1}{2}$	Phy. Tr.	$\frac{1}{4}$
Phy. Tr.	$\frac{1}{4}$		
	<hr/> $16\frac{3}{4}$		<hr/> $17\frac{3}{4}$

†See footnote, page 41.

II YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Math. 3 (Differential Calculus)	4	Math. 4 (Integral Calculus)	4
Physics 1	4	Physics 2	4
Chem. 3 (Quant. Anal.)....	4	Chem. 4 (Volumetric Anal.)	2
Civ. Eng. 1 (Surveying)....	4	Civ. Eng. 2 (Surveying)....	4
Mech. Arts 5 (Machine Shop)	2	Mech. Arts 6 (Machine Shop)	2
Mil. Sci.	$\frac{1}{2}$	Mil. Sci.	$\frac{1}{2}$
Phy. Tr.	$\frac{1}{4}$	Phy. Tr.	$\frac{1}{4}$
	$18\frac{3}{4}$		$18\frac{3}{4}$

III YEAR*

Math. 5 (Analytical Mechanics)	5	Math. 6 (Analytical Mechanics)	4
Mineral. 1 (Blow Pipe Analysis)	2	Mineral. 4 (Descriptive Mineralogy)	4
Civ. Eng. 11 (Hydraulics)	4	Civ. Eng. 14 (Materials of Construction)	4
Met. 1 (Introduction to Met.)	1	Met. 4-9 (Copper, Lead)	4
Met. 7-9 (Ore Dressing)	3		
Met. 5b (Met. Lab. Ore Dressing)	1		
	16		16

IV YEAR*

Chem. 5 (Special Quant.)	2	Chem. 6 (Special Quant.)	2
Mech. Eng. 3 (Heat Engines)	3	Elec. Eng. 9 (A. C. and D. C. Machinery)	3
Min. Eng. 1 (Lectures on Mining)	2	Mining Eng. 2 (Lectures on Mining)	2
Civ. Eng. 7 (Steel Mill Bldg's.)	4	Civ. Eng. 6 (Concrete and Masonry Construction)	4
Met. 3-9 (Gold, Silver)	3	Met. 10 (Concentrator and Smelter Design)	3
Met. 5a (Met. Lab. Gold, Silver)	1	Met. 6 (Thesis)	2
Total, 135 units.	15		16

*Geology 1, 2, may be taken in the third or fourth year by students whose records in preceding work are entirely satisfactory, when authorized by the President or the head of the Department of Metallurgy.

COURSE VII

Leading to the Degree of Bachelor of Science in Mining Engineering

I YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	4
Math. 1a (Algebra)	3	Math. 2 (Analytical Geom- etry)	5
Math. 1b (Trigonometry)	2	Chemistry 2	4
Chemistry 1	4	Mech. Arts 2 (Descriptive Geometry)	3
Mech. Arts 1 (Mech. Drawing)	2	Mech. Arts 4 (Forge Shop)	2
Mech. Arts 3 (Wood Shop)	2	Mil. Sci.	$\frac{1}{2}$
Mil. Sci.	$\frac{1}{2}$	Phy. Tr.	$\frac{1}{4}$
	$16\frac{3}{4}$		$17\frac{3}{4}$

II YEAR

Math. 3 (Differential Cal- culus)	4	Math. 4 (Integral Calculus)	4
Physics 1	4	Physics 2	4
Chemistry 3	4	Chemistry 4	2
Civ. Eng. 1 (Surveying)	4	Met. 2 (Assaying)	2
Mineral. 1 (Blow-Pipe An- alysis)	2	Civ. Eng. 2 (Surveying)	4
Mil. Sci.	$\frac{1}{2}$	Elective†	2
Phy. Tr.	$\frac{1}{4}$	Mil. Sci.	$\frac{1}{2}$
	$18\frac{3}{4}$	Phy. Tr.	$\frac{1}{4}$
			$18\frac{3}{4}$

SUMMER COURSE: Min. Eng. 8 (Mine Surveying), 4 units

III YEAR

Math. 5 (Analytical Me- chanics)	5	Math. 6 (Analytical Me- chanics)	4
Mineral. 3 (Crystallo- graphy)	2	Mineral. 4 (Descriptive Mineralogy)	4
Geology 1	4	Geology 2	4

III YEAR—CONTINUED

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Met. 3 (Gold and Silver), and Met. 5a (Labora- tory)	4	Elective* from Groups C and D	4
or			
Met. 7 (Ore Dressing), and Met. 5b Labora- tory)			
Elective* from Groups C and D	2		
			16
	17		

SUMMER WORK: Min. Eng. 7 (4 weeks practical work)

IV YEAR

Min. Eng. 1 (General Min- ing)	2	Min. Eng. 2 (General Mining)	2
Min. Eng. 3 (Designing) ..	1	Min. Eng. 4 (Designing) ..	1
Min. Eng. 5 (Mining Methods)	1	Min. Eng. 6 (Economics and Mining Law)	1
Geol. 3 (Economic Geology) ..	3	Geol. 4 (Ore Deposits) ..	3
Elective* from Engineering, Geology, and Mining ...	6	Elective* from Engineering, Geology, and Mining ...	6
	13		13

Total, 135 units.

ADVANCED DEGREES

Advanced degrees will be given only for work done in residence, to candidates who have received the Bachelor's degree from this institution or one of similar standing. Thirty units of such work will be required for the degrees of Master of Arts and Master of Science, together with a thesis. The courses in each case will be laid out by those in charge of the departments in which the work for the degree is to be taken, and must be approved by a committee composed of all the heads of departments.

*See footnote, page 41.

Students who expect to make mining engineering their profession are advised to take a fifth year, or a five-year course, since the four-years course gives insufficient time for a student to master all the subjects that are essential for the practice of mining engineering.

The requirements for the degree of Engineer of Mines are as follows:

Candidates must have completed the course leading to the degree of Bachelor of Science either in Mining Engineering, or in Metallurgy, as given by the University of Arizona, or the equivalent of either of these courses of some school of recognized standing.

The fifth year's course will consist of not less than 30 units of resident work, which will include (1) all of the following courses, the equivalent of which has not been taken by the candidate: Geology 1, 2, 3, 4, 5, 6, 7; Mineralogy 1, 2, 3, 4; Mining Engineering 1, 2, 3, 4, 5, 6, 7, 8; Metallurgy 1, 2, 3, 4, 5, 7. (2) At least 8 units of graduate work in Mineralogy, Geology, Mining Engineering or Metallurgy. (3) The remainder of the 30 units may be chosen from any of the engineering departments, but should not be of lower grade than Junior work. Six months of work underground and in smelters, with a satisfactory detailed report on the same, will be required. This work may be done during summer vacations.

COURSES OF INSTRUCTION

Courses having odd numbers are regularly given in the first semester; those having even numbers, in the second semester. The hours mentioned show the number of periods per week. The subjects are arranged alphabetically.

AGRICULTURE

PROFESSOR R. W. CLOTHIER AND ASSISTANT PROFESSOR W. L. FOWLER

1. Principles of Plant Culture. PROFESSOR CLOTHIER

A study of some of the fundamental laws governing the successful culture of plants such as purity and vitality of seeds; the relation of root development to moisture and plant food; the function of stem, leaf, bud, and flower, and conditions governing their normal development; the relation of the plant to light, heat, and cold, and other conditions of environment. Plant propagation, plant manipulation. Lectures and laboratory work. Required of all students in the long courses in agriculture, open to students in short course, and elective to preparatory students.

3 hrs., first semester. M W F, 8:30-9:25. 3 units.

2. FARM CROPS. PROFESSOR CLOTHIER

A brief study of some of the various farm crops grown in the United States, and a more detailed study of those that may be grown successfully in Arizona. Origin, history, description, methods of culture, and market demands. Required of all students in the long courses in agriculture, open to short course students, and elective to preparatory students.

3 hrs., second semester. M W F, 8:30-9:25. 3 units.

3. Live Stock Judging. ASSISTANT PROFESSOR FOWLER

Includes the judging of different classes of horses, cattle, sheep and swine. The first part of the work will be the use of the score card, and in the latter part, practice in comparative judging will be given. Animals from the college herd, supplemented by live stock belonging to neighboring ranchmen and farmers, are used. Required of all

students in the long courses in agriculture, open to short course students, and elective to preparatory students. Text: Craig's *Judging of Live Stock*.

3 hrs., first semester. Tu Th S, 8:30-9:25. 3 units.

4. Elements of Dairying. ASSISTANT PROFESSOR FOWLER

The lectures and recitations include a study of the secretion and composition of milk and the causes of variation in composition; the Babcock test applied to milk; the various methods of cream raising, including a study of the construction and operation of centrifugal separators; methods of making and marketing butter; proper handling of milk on the farm, etc. The laboratory work includes testing milk and other dairy products, operation of different makes of cream separators, and making butter. Required of all students in the long courses in agriculture, open to students in the short courses, and elective to preparatory students.

3 hrs., second semester. Tu Th S, 8:30-9:25. 3 units.

5. Home and Market Gardening. PROFESSOR CLOTHIER

Practical and theoretical training in the general principles underlying successful intensive farming, and detailed study of the various crops grown in the home and market garden with special reference to Arizona conditions. Lectures, laboratory and practice on the farm. Required of students in horticulture. Open to students in the short course.

3 hrs., first semester. Tu Th S, 8:30-9:25. 3 units.

6. Plant Breeding. PROFESSOR CLOTHIER

A brief study of the general principles of plant breeding, and a more detailed study of the methods pursued and results obtained by leading plant breeders in the various experiment stations and in private work. Required of all students in agronomy and horticulture.

3 hrs., second semester. Tu Th S, 8:30-9:25. 3 units.

7. Cereals. PROFESSOR CLOTHIER

While cereal culture and grain judging will be the main features of this course it is intended to be a continuation of the work begun in the study of farm crops (agriculture 2) so that in the two courses a

detailed study of all the leading farm crops will be given. Required of students in agronomy.

3 hrs., first semester. M W F, 10:20-11:15. 3 units.

8. Milk Production.

ASSISTANT PROFESSOR FOWLER

A study of the dairy herd and the production of milk from the standpoint of the practical farmer. The lectures include leading breeds of dairy cattle, their characteristics and adaptations to dairy purposes; the selection, breeding and building up of a dairy herd; calf raising; the dairy barn; feeding for milk production; use of by-products from the dairy. The laboratory work consists of judging the leading dairy breeds as to breed character, dairy type, etc. Open to all students in agriculture who have had agriculture 4. Required of students in animal husbandry.

3 hrs., second semester. Tu Th F, 1:00-1:55. 3 units.

9. Soil Physics.

PROFESSOR CLOTHIER

Origin, composition and classification of soils; soil temperature and conditions influencing it; soil texture and soil structure as related to tillage, moisture and plant food; various culture methods based on physical properties of soils; irrigation and drainage; mechanical analysis. Required of all students in the long courses in agriculture. Open to short course students.

3 lectures and one 3 hour laboratory period, first semester. M W F, 9:25-10:20; W, 1:00-3:45. 4 units.

10. Soil Fertility.

PROFESSOR CLOTHIER

The amount and availability of the various elements of plant food in soils; the relation of humus to soil fertility; commercial fertilizers and their application; control of alkali; making and using farm manures; crop rotations; the Rothamstead experiments; the theory of toxic substances in soils. Required of all students in the long courses in agriculture. Lectures and laboratory work.

3 lectures and one 3 hr. laboratory period, second semester. M W F, 9:25-10:20; W, 1:00-3:45. 4 units.

11. Veterinary Physiology.

ASSISTANT PROFESSOR FOWLER

Special physiology of farm animals. Lectures and recitations supplemented by practical experiments in the laboratory. Text: Smith's

Veterinary Physiology. Required of all students in the long courses in agriculture.

3 hrs., first semester. M W F, 8:30-9:25. 3 units.

12. Animal Diseases. ASSISTANT PROFESSOR FOWLER

(a) A study of the general and specific causes of diseases and methods of prevention; errors in feeding and care of animals; sanitation of stables, feeding pens and pastures; preventive inoculation; tuberculin test and veterinary regulations. (b) Diagnosis and treatment of common ailments of farm animals. (c) Simple surgical operations; control of hemorrhage, dressing of wounds, care of the teeth, care of the feet, castration, spaying and caponizing; correction of malpositions and removal of placenta in obstetrical cases, etc.

Text-books: Reynolds' *Veterinary Studies*, Mayo's *Care of Animals*.

Prerequisites: Zoology 1, Veterinary Physiology, and the student must be registered in Chemistry I or Chemistry III, and in Zoology

2. Lectures recitations and clinics. Required of all students in the long courses in agriculture.

3 hrs., second semester. M W F, 8:30-9:25. 3 units.

13. Pomology. PROFESSOR CLOTHIER

Orchard management, and a detailed study of deciduous fruits, including planting, cultivation, pruning, spraying, and description and history of varieties. Attention will be given to fruit judging. Lectures and laboratory work. Open to students in agronomy in the junior year. Required of students in horticulture.

4 hrs., first semester. M W F, 11:15-12:10; Tu, 1:00-1:55. 4 units.

14. Citrus Fruits. PROFESSOR CLOTHIER

A detailed study of the culture of citrus fruits with special reference to the citrus districts in the United States. Citrus nursery management; citrus orchard management; citrus insects and diseases; packing and marketing; judging. Open to students in agronomy in the junior year. Required of students in horticulture. Lectures and Laboratory work.

4 hrs., second semester. M W F, 11:15-12:10; Tu, 1:00-1:55. 4 units.

15. Poultry Husbandry. ASSISTANT PROFESSOR FOWLER

The general care and management of poultry, production of poultry for the market, diseases and pests, breed characteristics. Recitations, lectures and laboratory work including visits to specialized poultry ranches. Required of students in animal husbandry, open to short course students and elective to preparatory students.

3 hrs., first semester. M W F, 10:20-11:15. 3 units.

16. History of Breeds. ASSISTANT PROFESSOR FOWLER

The characteristics of each breed of horses, cattle, sheep, swine and goats are considered at length, and each breed is discussed with reference to its origin, history and development, introduction to America and adaptability to Arizona conditions. Required of students in animal husbandry, open to short course students and elective to preparatory students. Textbook: Plumb's *Breeds of Farm Animals*.

3 hrs., second semester. M W F, 10:20-11:15. 3 units.

17. Animal Breeding. ASSISTANT PROFESSOR FOWLER

The principles of breeding, including selection, heredity, atavism, reversion, variation, correlation, with a presentation of methods of breeding, such as line breeding, in-breeding, in-and-in breeding, cross breeding, etc. Open to students above the sophomore year in college. Required of students in animal husbandry. Text: Davenport's *Principles of Breeding*.

3 hrs., first semester. M W F, 11:15-12:10. 3 units.

18. Feeds and Feeding. ASSISTANT PROFESSOR FOWLER

The principles of animal nutrition; composition and digestibility of various feeds; construction and use of silos; balanced rations; economical feeding of animals for various purposes. Prerequisites: chemistry III and veterinary physiology. Required of students in animal husbandry. Elective to students in agronomy and horticulture.

3 hrs., second semester. M W F, 11:15-12:10. 3 units.

19. Small Fruits. PROFESSOR CLOTHIER

A detailed study of the small fruits such as the strawberry, the grape and the various bush fruits. Required of students in horticulture.

ture. Elective to students in agronomy and animal husbandry.
3 hrs., first semester. Tu Th S, 9:25-10:20. 3 units.

20. Horticultural Literature. PROFESSOR CLOTHIER

Throughout the course in horticulture the student will be frequently referred to standard works and to bulletins dealing with special investigations. This course is intended to round out the knowledge thus gained by assigning certain readings in bulletins and standard works upon horticulture upon which the student is required to make daily and weekly reports, which will give him a comprehensive view of the general field of horticulture and lay the foundation for research work. Required of students in horticulture.

3 hrs., second semester. Tu Th S, 9:25-10:20. 3 units.

21. Advanced Live Stock Judging. ASSISTANT PROFESSOR FOWLER

Show yard judging; relation of pure bred live stock to market classes; method of comparative judging. Trips are made to large herds and students are required to spend several days at the State Fair at Phoenix, judging live stock. Prerequisites: Live Stock Judging 3, and History of Breeds 16. Required of students in animal husbandry. Elective to students in agronomy and horticulture.

3 hrs., first semester. Tu Th S, 11:15-12:10. 3 units.

22. Live Stock Investigations. ASSISTANT PROFESSOR FOWLER

A survey of live stock conditions. Advanced studies of special phases of animal production. Required of students in animal husbandry.

3 hrs., second semester. Tu Th S, 11:15-12:10. 3 units.

23. Meat Production. ASSISTANT PROFESSOR FOWLER

Practical methods of producing cattle, sheep and swine, including a consideration of successful practices in feeding for market, fitting of show and sale, etc. Required of students in animal husbandry.

3 hrs., first semester. M W F, 9:25-10:20. 3 units.

24. Animal Husbandry Literature. ASSISTANT PROFESSOR FOWLER

A study of books, magazines and a review and compilation of bulletins devoted to animal husbandry. The student will be required to use the herd books of the different breeders' associations in studying

the pedigrees of the best individuals in the more popular breeds of horses, cattle, sheep and swine. Required of students in animal husbandry.

3 hrs., second semester. M W F, 9:25-10:20. 3 units.

25. Agronomy Literature.

PROFESSOR CLOTHIER

Daily and weekly reports upon assigned readings in bulletins and standard works. Designed to round out the student's knowledge of the general field of agronomy, and to prepare the way for research in the subject. Required of students in agronomy. Elective to students in horticulture and animal husbandry.

3 hrs., first semester. Tu Th S, 10:20-11:15. 3 units.

26. Farm Management.

PROFESSOR CLOTHIER

This course will deal with the purchase, organization, equipment and management of farms with reference to financial returns. Farm accounts, market demands, marketing associations, the farm lay-out, farm buildings, leveling for irrigation, location and management of ditches, etc., are among the subjects to be discussed. Required of students in all long courses in agriculture.

2 lectures and one 3-hr. laboratory period, second semester. Tu Th S, 10:20-11:15. 3 units.

ASTRONOMY

PROFESSOR DOUGLASS

The atmosphere of southern Arizona is perhaps the best in the United States for astronomical observation, having smaller percentage of cloud and less average wind velocity than any other locality where records have been preserved. The dry air and 2400 feet elevation give Tucson such a clear sky that faint stars may be watched till they set behind the distant horizon; the fine weather, day after day, gives opportunity for consecutiveness of observation not obtainable elsewhere; a greater portion of the year is available, with less interference from air currents.

The course in astronomy is arranged especially to draw attention to these advantages, and, at the same time, to give that understanding of the motions of the earth and planets which is so important in many

branches of engineering. The eight-inch Harvard telescope with its Clark glass and the four and one-fourth inch Brashear telescope of the University will always be available for closer study of the heavenly bodies. Two excellent clocks with electric connections for transmitting time give opportunity for longitude, latitude and time observations. It is hoped in the coming year to install other instruments that will take advantage of the exceptionally favorable conditions so peculiar to Arizona.

1. 2. Descriptive Astronomy.

PROFESSOR DOUGLASS

The study of the sun, moon, and planets and other celestial objects, with constant views of their telescopic appearance, and discussion of the latest theories of the evolution of the universe and the condition of the planets. Non-mathematical; open to all students.

2 hrs., or an equivalent, both semesters. M W, 2:50-3:45. 2 units, each semester.

3. Engineering Astronomy.

PROFESSOR DOUGLASS

Latitude, longitude, and time observations, and their reductions, with practice work; astronomical measurements; adjustment and handling of instruments. Course 3 is required of juniors in civil engineering.

3 hrs., or an equivalent, first semester. M W, 11:15-12:10, W evening. 3 units.

BOTANY

PROFESSOR THORNBERRY, MR. BROWN

The courses which follow, revised for 1910-1911, are calculated to articulate with the work done in biology in the average western high school.

1. Elementary Botany.

MR. BROWN

This course presents a general view of the four great groups of plants. It includes the morphology of types and their genetic relations. A required course for further botany. Texts: Bergen and Davis, *Principles of Botany*; Coulter, *Plant Studies*.

2 hrs. and 4 hrs. of laboratory work, first semester. M W, 1:00-3:45. 4 units.

2. Plant Histology.**MR. BROWN**

Lectures on microscopy, botanical microtechnique, the use of the camera lucida, the photographic camera. In the laboratory the greater part of the semester is given over to the use of the various chemical reagents and stains in the preparation of microscopic slides. This course is given for those who intend to teach botany and for those who are preparing to take advanced courses in this department. Text: Chamberlain, *Methods in Plant Histology*. Prerequisite, Botany 1.

1 hr. of lecture and 6 hrs. of laboratory work, second semester. M, 1:00-3:45; Tu W, 1:00-2:50. 4 units.

3. Plant Physiology.**MR. BROWN**

An elementary course in the life processes of plants. The laboratory work consists of an investigation of the properties of protoplasm; the relations of plants to mechanical forces; the influence of chemicals upon plants; the relation of plants to water, gravitation, light, respiration, growth, and movement. The laboratory, which is newly equipped, is situated in the center of a region most interesting to the physiologist. Text: MacDougal, *Textbook of Plant Physiology*. Prerequisite, Botany 1.

1 hr. of lecture and 7 hrs. of laboratory work, first semester. 4 units.

4. Taxonomy.*MR. BROWN**

A course consisting of the analysis of plants in the field. During the semester several excursions are made to the mesas, mountains and canyons. This course is intended not only for students who expect to continue the study of botany, but also for those who desire to know something of the desert flora. Text: Coulter and Nelson, *A New Manual of Rocky Mountain Botany*. Open to all college students.

1 hr. of lecture and 6 hrs. laboratory work, second semester. Tu W Th, 1:00-2:50; F, 1:55-2:50. 4 units.

5. Geographic Botany.*MR. BROWN**

Plant distribution over the surface of the earth, with the reasons for such distribution. The general aspect of the vegetation character-

*Omitted 1910-1911.

istic of the hygrophytic forest, the tropophytic forest, the sclerophyll forest, the savannah, the steppe, the desert, the tundre, etc. The student is expected to do a considerable amount of reading in addition to the class room and field work. The lectures will frequently be illustrated. No laboratory work. Prerequisite, Botany 4.

4 hrs., first semester. Tu Th F, 1:00-1:55; W, 3:45-4:40. 4 units.

*6. General Morphology of Algae and Fungi. MR. BROWN

Open to college students who have completed courses 1 and 2. Consult the instructor before registering. Prerequisites, Botany 1, 2.

Hours to be determined. 4 units.

*7. General Morphology of Bryophytes and Pteridophytes.

4 units.

*8. General Morphology of Spermatophytes.

4 units.

*9. History of Botany.

A lecture course dealing with: (a) early descriptive botanists; (b) the period of artificial systems; (c) the beginning and development of modern botany; (d) botany and botanists of today. This course requires library work. Prerequisites, Botany 1, 2, 3, 4, 5. 4 units.

†11. Plant Pathology.

A study of the principal groups of parasitic fungi and the plant diseases caused by them, together with the methods of investigation and control. Attention is given to external factors producing pathological conditions in plants. Prerequisites, Botany 1 and 3.

1 hr. lecture and 5 hrs. laboratory work, first semester. 3 units.

†12. Plant Pathology.

Continuation of course 11. First semester, 3 units.

CHEMISTRY

PROFESSOR GUILD, ASSISTANT PROFESSOR BENNER AND MR. KLEEBERGER

The instruction in chemistry has two main objects in view: first, to promote general culture; and second, to introduce students to

*Omitted 1910-11.

†Not offered during the school year 1911-1912.

technical work, especially in mining. The first two years' work in general chemistry, qualitative and quantitative analysis, places the student in a position to take up advantageously the study of mining, agricultural chemistry or metallurgy.

1, 2. General Chemistry and Qualitative Analysis.

PROF. GUILD, ASST. PROF. BENNER, MR. KLEEBERGER

Lectures and recitations illustrating the chemical properties of the elements and their compounds. Textbooks: Kahlenberg, *Outlines of Chemistry*; Elliot and Storer, *Qualitative Analysis*, and various reference books. Open to all students who have taken courses amounting to one year each in preparatory chemistry and physics.

2 hrs. and two 3-hr. laboratory periods, both semesters. Tu Th, 11:15-12:10; Th F, 1:00-3:45. 4 units, each semester.

3. Quantitative Analysis. ASSISTANT PROFESSOR BENNER

Laboratory practice, with lectures and recitations; the work will be chiefly in gravimetric methods of analysis. For students in agriculture, special problems in agricultural chemistry, such as analysis of water, soils, and fertilizer will be considered. Open to all students who have taken Chemistry 2.

4 hrs., or an equivalent, first semester, M T W, 1:00-3:45. 4 units.

4. Volumetric Analysis. ASSISTANT PROFESSOR BENNER

A continuation of the work in Chemistry 3, special attention being given to the methods of assaying employed in the West.

4 hrs., or an equivalent, second semester. M T W, 1:00-3:45. 2 units if discontinued March 15th; otherwise, 4 units.

5, 6. Special Quantitative Analysis. ASSISTANT PROFESSOR BENNER

The analysis of water, gases, oils, minerals. Open to students who have taken Chemistry 4.

4 hrs., or an equivalent, both semesters. M T W, 1:00-3:45. 4 units, each semester.

***7, 8. Organic Chemistry. PROFESSOR GUILD**

Lectures on the carbon compounds; laboratory work in organic

*Omitted 1910-11.

analysis and the preparation of organic compounds; vapor density and molecular weight determination. Open to students who have taken Chemistry 3, 4.

4 hrs., or an equivalent, both semesters. 4 units, each semester.

9. Synthetic Chemistry. PROFESSOR GUILD

The preparation of pure chemical compounds from the crude mineral products. Open to students who have taken Chemistry 4.

2 hrs., or an equivalent, first semester. 2 units.

10. Physical Chemistry. PROFESSOR GUILD

Lectures. Historical introduction leading up to a discussion of modern chemical theories. Open to students who have taken Chemistry 3.

4 hrs., second semester. 2 units.

***11, 12. Chemistry of the Rare Elements.**

ASSISTANT PROFESSOR BENNER

The analysis and synthesis of uranium, molybdenum, tungsten, vanadium and cerium compounds. Open to students who have taken Chemistry 6, 9.

4 hrs., or an equivalent, both semesters. 4 units, each.

CIVIL ENGINEERING

PROFESSOR WATERBURY, MR. SNOW, MR. RODOLF

The courses in this department have been arranged with special reference to the engineering development of the Southwest. Stress is laid on surveying, railroad and structural work, and irrigation engineering. The design throughout the courses is to give the student a thorough and practical knowledge of the essential principles of his profession, and to teach the technical practice of the times, so far as possible, without sacrificing in other directions.

Some of the courses in civil engineering are offered on a consultation basis. For such courses the class will not meet in a body and therefore class periods will not be scheduled. Each student will arrange with the instructor for the required consultation periods. In

*Omitted 1910-11.

general, two or three consultation periods per week, in each subject, will be required of each student. For courses requiring laboratory or drafting work the student must spend as much time in the laboratory or drafting room as may be required to complete the assigned work.

1. Elementary Surveying. **PROFESSOR WATERBURY, MR. SNOW**

Use and care of surveying instruments, United States system of land surveys, city surveys, computations. Lectures, recitations, drawing, and fieldwork. Textbooks, Johnson's *Surveying*, and Pence and Ketchum's *Surveying Manual*. Open to students who have taken trigonometry, and who have taken or are taking Mechanic Arts 1.

4 hrs., first semester. M W F, 8:30-9:25 (lectures); S, 8:00-12:00 (fieldwork). 4 units.

2. Topographic and Mine Surveying.

PROFESSOR WATERBURY AND MR. RODOLF

A continuation of the work given in Civil Engineering 1. The work of the second semester includes topographic surveying, hydrographic surveying, patent surveys, and underground surveying. Open to students who have taken Civil Engineering 1.

4 hrs., second semester. M W F, 8:30-9:25 (lectures); S, 8:00-12:00 (fieldwork). 4 units.

3. Geodesy.

PROFESSOR WATERBURY

A study of precise triangulation work, including the measurement of base lines, measurement of angles, adjustment and computation of triangulation systems, and the adjustment of precise level circuits. Open to students who have taken Civil Engineering 1, 2, and Astronomy 3 or 4. This course may be taken as a consultation course.

1 hr., first or second semester. 1 unit.

6. Concrete and Masonry Construction. **PROFESSOR WATERBURY**

The theory and practice in reinforced concrete construction. Foundations on land and in water, cofferdams, cribs, caissons, piers, and abutments, retaining walls, dams, and arches. Textbook, Baker, *Masonry Construction*. Open to students who have taken Civil Engineering 14. This course may be given as a consultation subject.

2 hrs., and two 3-hr. laboratory and drafting periods, second semester. W, 10:20; Th, 9:25; F, 9:25-12:10; Th, 1:00-3:45. 4 units.

7. Steel Mill Buildings.**PROFESSOR WATERBURY**

Graphical and analytical computation of stresses in roof and bridge trusses; a study of the details of structural steel designing; complete design with drawings, estimate of weights, and estimate of cost for a steel mill building. Text-book: Ketchum, *Steel Mill Buildings*. Open to students who have taken Civil Engineering 14. This course may be given as a consultation subject.

2 hrs., and two 3-hr. drafting periods, first semester. Tu Th, 10:20-11:15; Tu Th, 1:00-3:45. 4 units.

8. Bridge Design.**PROFESSOR WATERBURY**

Computation of stresses due to moving loads upon various points of bridge structures; a detailed study of bridge designs and bridge erections; complete investigation with drawings, estimate of weights, and estimate of cost of a steel bridge. Text-book: Ketchum, *Design of Highway Bridges*. Open to students who have taken Civil Engineering 7. This course may be given as a consultation subject.

2 hrs., and two 3-hr. drafting periods, second semester. Tu Th, 10:20-11:15; Tu Th, 1:00-3:45. 4 units.

9, 10. Railroad Engineering.*PROFESSOR WATERBURY**

Preliminary and location surveys; simple and easement curves, turnouts and switches; principles of economic location as based upon cost of construction, operating expenses, alignment, and grades; maintenance of way. The fieldwork consists of the surveys for a railroad of sufficient length to secure familiarity with the methods of actual practice. Each student makes a complete set of notes, maps, profiles, calculations and estimates of cost. Text-book: Allen, *Railroad Curves and Earthworks*. Open to students who have taken Civil Engineering 1, 2.

1 hr., and one 4-hr. field period, both semesters. M, 10:20-11:15; Tu, 1:00-4:40. 2 units, each semester.

11. Hydraulics.**PROFESSOR WATERBURY**

Velocity and discharge from orifices, weirs, tubes, and pipes; flow in sewers, ditches, canals and rivers; measurement of water power;

*Omitted 1910-1911.

water wheels of various types. Text-book: Merriman, *Hydraulics*. Open to students who have taken Civil Engineering 1, 2 and Mathematics 4.

4 hrs., first semester. Tu W Th F, 9:25-10:20. 4 units.

13. Irrigation Engineering.

PROFESSOR WATERBURY

A study of the engineering principles relating to the construction and maintenance of canals and reservoirs and the various means of diverting, measuring, and pumping water for use in irrigation. Text-book: Wilson, *Irrigation Engineering*. Open to students who have taken Civil Engineering 1, 2, 11, 14.

3 hrs., and one 3-hr. laboratory and drafting period. M W F, 11:15-12:10; W, 1:00-3:45. This course may be given as a consultation subject. First semester, 4 units.

14a. Mechanics of Materials.

PROFESSOR WATERBURY

The analysis and computation of stresses in prisms, beams, columns, and shafts. Text-book: Merriman, *Mechanics of Materials*. Open to students who have taken or are taking Mathematics 5, 6.

3 hrs., second semester. Tu W F, 9:25-10:20. 3 units.

14b. Materials Testing.

PROFESSOR WATERBURY

Laboratory work in the testing of materials used in engineering construction, including cement, concrete, wood, iron, and steel. Open to students who are taking or have taken Civil Engineering 14a.

One 3-hr. laboratory period, second semester. W, 1:00-3:45. 1 unit.

*15. Contracts and Specifications.

PROFESSOR WATERBURY

The essential elements of a contract; items included in various kinds of engineering contracts and specifications; the preparations of a complete set of specifications and a contract. Text-book: Johnson, *Engineering Contracts and Specifications*. Open to all college students. This course may be given as a consultation subject.

2 hrs., first semester. Tu Th, 8:30-9:25. 2 units.

*Omitted 1910-11.

16. Thesis.†

PROFESSOR WATERBURY

Assigned work on an investigation, design, or original research. No student will be permitted to register in this subject unless his previous work has been of high grade. Open to senior students in civil engineering.

First or second semester. Tu Th, 8:30-9:25. 2 units.

17. Public Water Supplies.

PROFESSOR WATERBURY

Methods of investigation of available supplies of use, including a study of results of chemical analysis of water, and the bacterial examination of water;‡ methods of purification of water; and a study of the design of water systems. Text-books: Turneaure and Russell, *Public Water Supplies*, and Mason, *Examination of Water*. Open to students who have taken or who are taking Civil Engineering 11. This course may be given as a consultation subject.

3 hrs., first and second semester. M W F, 7:35-8:30. 3 units.

*18. Sewerage.

PROFESSOR WATERBURY

Methods of sewerage purification; a study of sewerage disposal plants; and a study of the design of sewer systems. Text-book: Folwell, *Sewerage*. Open to students who have taken or are taking Civil Engineering 11. This course may be given as a consultation subject.

3 hrs., first or second semester. M W F, 7:35-8:30. 3 units.

19. Agricultural Surveying.

PROFESSOR WATERBURY

An elementary course in surveying for students in agriculture. The work includes a study of the construction and use of surveying instruments, and a study of surveying operations which have particular application in agricultural and irrigation work. Text-book: Pence

†See rules governing thesis, page 51.

‡The Department of Civil Engineering is very much indebted to Dr. A. G. Schnabel, City Bacteriologist, for having permitted the class in this subject to make use of his laboratory, in making bacterial examinations of water.

*Omitted 1910-1911.

and Ketchum, *Surveying Manual*. Open to students who have had high school or preparatory algebra.

2 hrs. and one 3-hr. field period, first semester. Tu Th, 11:15-12:10; M, 1:00-3:45. 3 units.

20. Principles of Irrigation.

PROFESSOR WATERBURY

A study of methods of irrigation, measuring water for use in irrigation, present condition of irrigation development in the United States, irrigation legislation, and methods of establishing water rights. Open to students who have had Civil Engineering 19.

2 hrs. and one 3-hr. laboratory period, second semester. Tu Th, 11:15-12:10; M, 1:00-3:45. 3 units.

ECONOMICS

PROFESSOR CHANDLER

1. Principles of Economics.

PROFESSOR CHANDLER

A study of the main principles which underlie the science. Special emphasis is placed upon practical illustrations drawn from business activities of today. The text used is *Outlines of Economics*, by Ely, Adams, Lorenz, and Young. Open to sophomores and upper class men.

3 hrs., first semester. M W F, 10:20-11:15. 3 units.

2. American Business and the Tariff Question.

PROFESSOR CHANDLER

A study of the rise of the factory system in the United States, and the origin and development of the leading American industries of today. The history of the tariff from 1789 to 1911 and its relation to the development of agriculture, manufacture and commerce. Special topics dealt with are: trusts in their relation to high protection; bearing of the tariff upon increased cost of living; conservation of natural resources in relation to the tariff; high protection and decline in American shipping; needed tariff reform; reciprocity; the tariff commission. Open to all college students who have had economics 1.

3 hrs., second semester. M W F, 10:20-11:15. 3 units.

3. The Trust Problem.**PROFESSOR CHANDLER**

Causes of modern industrial combinations and development of great trusts of today; problems attending the expansion of corporate enterprise; relative merits of unrestricted competition and combination from the point of view of business efficiency and American supremacy in world markets; rights and struggles of the independent entrepreneur; monopoly price and methods; relation of the courts to trust supremacy and restraint of trade; constitutional decisions affecting the controversy of personal versus property rights; Federal and State regulation; Sherman Anti-trust Act; Federal powers under interstate commerce clause; function of the public service commission. Open to all college students who have had economics 1.

2 hrs., first semester. T Th, 10:20-11:15. 2 units.

4. Transportation and Commerce.**PROFESSOR CHANDLER**

Three phases of transportation are studied:

1. The rise of the American railway system, and its past and present relation to the development of agriculture, manufacturing, and other industries.

2. The present American railway system—its business organization, methods of combination and financial operations.

3. Relation of the railroad to the government and the public; rights of the shipper and the investor in railway securities; the Interstate Commerce Commission and Federal control of commerce; proposed reforms in State and Federal regulation, including a study of government ownership in Europe and Australia, with a discussion of its practical value if applied to American conditions. Open to all college students who have had economics 1.

2 hrs., second semester. T Th, 10:20-11:15. 2 units.

5. Corporation Organization and Finance. **PROFESSOR CHANDLER**

A study of the business side of the corporation, including:

1. Organization and management; how and where to organize; powers and privileges of corporations in the different states; minority rights; comparative merits of the individual, partnership, and corporation.

2. Methods of business consolidation; pools; trusts; holding companies; mergers; syndicates; agreements; community of interest.

3. Financial agents and institutions; promoters; stock brokers; stock exchanges; stock market; money market; function of Wall Street.

4. Investments and securities; methods and laws of investment and speculation; relative merits of railway stocks, bonds, municipal and county bonds, franchise, and industrial securities.

2 or 3 hrs., first semester. Tu Th, 11:15-12:10. 2 or 3 units.

6. Money, Banking and Finance. PROFESSOR CHANDLER

The functions of money and its relation to credit institutions; the monetary system of the United States; the theory and history of banking; function of the savings bank, the trust company, the clearing house, etc.; history of American finance, and financial crises in their relation to our present currency and banking systems; the examination of the principal banking systems of the world with a view to finding ideas which, if applied to American conditions, would render our system more nearly conformable to our growing financial and commercial needs. Open only to juniors and seniors who have had at least one year of economics.

2 or 3 hrs., second semester. Tu Th, 11:15-12:10. 2 or 3 units.

***7. Introduction to the Study of Society. PROFESSOR CHANDLER**

2 or 3 hrs., first semester. Tu Th. 2 or 3 units.

***8. Socialism and Social Reform. PROFESSOR CHANDLER**

2 or 3 hrs., second semester. Tu Th. 2 or 3 units.

9. Labor Problems. PROFESSOR CHANDLER

The study of the labor question in the first semester is divided into four parts:

1. Origin of the labor problem and history and growth of labor organizations.

2. Economic and social condition of the working classes in the United States and Europe today, including study of child and woman labor; immigration and its relation to wages and the standard of

*Not given in 1910-11.

living of American workmen; sweating system; poverty and unemployment.

3. Conflict of organized labor vs. organized capital; strikes and lockouts; the closed vs. the open shop; the secondary boycott; collective bargaining, etc.; employers' organizations.

4. Political and legal aspects; the use and abuse of the injunction; state in relation to labor; police power; recent court decisions; the laborer in politics.

2 or 3 hrs., first semester. 2 or 3 units.

10. Economic Reform Movements.

PROFESSOR CHANDLER

This course logically follows Economics 9. It continues the study of the labor question with emphasis placed upon the constructive side. The chief proposals for the solution in America, Europe and Australia are studied, including: profit sharing; co-operation; industrial education; compulsory arbitration; labor legislation in the United States, etc.

2 or 3 hrs., second semester. 2 or 3 units.

11. Business Principles and Economics.

PROFESSOR CHANDLER

This course is offered especially for engineering students and others who have only a very limited time to study economics. The purpose of the course is to give students a general knowledge of those principles of practical business and finance which will be of value to engineers and business men. Not open to students who have had Economics 5 or 6.

1 or 2 hrs., both semesters. Hour to be arranged. 1 or 2 units, each semester.

12. Discussion of Public Questions.

PROFESSOR CHANDLER

The purpose of this course is to give students training in the handling of public questions, political, economic and social, by means of discussions and debates. Open to all college students.

1 hr., first semester. 2 units.

ELECTRICAL ENGINEERING

PROFESSOR HENLEY AND MR. SNOW

The object of the course in electrical engineering is to furnish

thorough instruction and practical training in applied electricity and allied subjects. The course is designed to train the student in those fundamental principles of science of which a broad knowledge is necessary to form the basis of successful specialization. The laboratory work is designed to supplement the lecture and recitation work in training the student to see the close relation between theory and the actual operation, and to encourage individual judgment rather than the mere development of skill.

The work in electrical engineering proper does not commence until the first semester of the Junior year, but a course in electricity and magnetism may be elected in Sophomore year. Besides the electrical work courses are given in other engineering subjects, and the electives give opportunity for work along non-engineering lines.

1. Elements of Electrical Engineering.

MR. SNOW

A general elementary study of the principles of electrical engineering. Taking up a brief history of the development of the electrical industry, including the modern applications of electricity to transmission of power, electric lighting, the telephone, street cars, etc. The theory of the generation and transmission of both direct and alternating currents, the advantages and disadvantages in the use of both.

2 hrs., first semester. W Th, 11:15-12:10. 2 units.

2. Dynamo-Electric Machinery.

MR. SNOW

This course is in part a continuation of E. E. 1. It includes the study of electric illumination, comparing the various light sources, their relative values under different conditions, cost and efficiency of operation. This course will include one 3 hour period in the laboratory, making different connections on motors and generators, running machines and making simple tests of them.

Second semester. W Th, 11:15-12:10, 3:00, 9:25-12:10. 3 units.

3. Electrical Machinery.

MR. SNOW

A study of the fundamental laws of the electromagnetic and electrostatic circuits. Algebraic and geometric treatment of electrical problems, in such a manner that an analysis of the structural and performance characteristics of electrical machinery may be easily followed.

2 hrs., first semester. Tu Th, 8:30-9:25. 2 units.

4. Electric Traction.**MR. SNOW**

A study of the practical application E. E. 3 to generators, motors, transformers, etc. Electric railways are studied during the second part of the semester, including the railways, generators, rotary-convertisers, the different types of motors as applied to the work, a comparison of the direct and alternating current systems in electric railroad work.

2 hrs., second semester. Tu Th, 8:30-9:25. 2 units.

5, 6. Electrical Engineering Laboratory.**MR. SNOW**

A study of the operation and characteristics of commercial machines, making complete tests of generators, motors both direct and alternating current, transformers, synchronous converter, etc. The object being to have the student become familiar with the actual operation of the machines, the common causes of trouble and their remedy.

Two 3-hr. periods, both semesters. W Th, 1:00-3:45. 2 units, each semester.

7. Design of Electrical Machinery and Apparatus.**MR. SNOW**

Paralleling E. E. 3. A study of the effect of design on the characteristics, cost of operation and performance of electrical machinery and apparatus. Practical calculations for the design of lifting magnets, finding and plotting the characteristics and predetermination of the operation of generators, motors, transformers and transmission lines.

Two 3-hr. periods, first semester. 2 units.

8. Electric Power Station Design.**MR. SNOW**

The selection and arrangement of electric power station equipment, wiring diagrams and switch-board connections. Transmission line design, and calculations of cost of operation, estimated cost of power delivered, power rates, etc.

9. Alternating and Direct Current Machinery.**MR. SNOW**

A general course in the study of electrical engineering, covering electric lighting, transmission and distribution, and the construction

and operation of alternating and direct current generators and motors. Intended for non-electrical engineering students.

2 hrs. and one 3-hr. period, first or second semester. W Th, 10:20-11:15; Th, 1:00-3:45. 3 units.

10. Seminar. PROFESSOR HENLEY OR MR. SNOW

Discussion of various subjects which arise in connection with work, and review of current engineering literature.

1 hr., second semester. Th evening. 1 unit.

ENGLISH

PROFESSOR BATES, MISS PERRY, MISS LUTRELL

The purpose of the literary courses outlined below is to give a general knowledge of English literature from its beginnings to the present time, chief stress being laid upon the study of representative authors, but with broader literary movements constantly in mind. The courses in composition aim to develop accurate thought and clear, vigorous expression; opportunity for work in advanced composition is afforded in connection with the courses in literature.

1. Composition. MISS PERRY

Narration and description; lectures and the study of Nettleton's *Specimens of the Short Story*; daily and weekly themes. Prescribed for all freshmen.

3 hrs., first semester. M W F, 9:25-10:20. 3 units.

2. Composition. MISS PERRY

Exposition and argumentation; study of Perry's *Argumentation*, class debates, impromptu speeches, and frequent themes. Prescribed for all freshmen.

3 hrs., second semester. M W F, 9:25-10:20. 3 units.

3, 4. History of English Literature. PROFESSOR BATES

An outline of English Literature from its beginnings down to the present time. Moody and Lovett's *History of English Literature* used as a text-book. Assigned readings from numerous authors. This course is preliminary to all other courses in English literature.

2 hrs., both semesters. Tu Th, 9:25-10:20. 2 units, each semester.

5, 6. Elizabethan Drama.

PROFESSOR BATES

Attention is given first to the development of the Elizabethan drama from the Miracle Plays, Moralities and Interludes; the Senecan influence is studied, and the work of Lylly, Greene, Peele, Kyd, and Marlowe briefly considered; then the bulk of the year is given to a close detailed study of the leading plays of Shakespeare, followed by a cursory treatment of the post-Shakespearian drama, at least one play being read from each of the following writers: Jonson, Beaumont and Fletcher, Heywood, Webster, Middleton, Massinger and Ford. Lectures and discussions and a thesis of not less than 2,000 words.

3 hrs., both semesters. M W F, 8:30-9:25. 3 units, each semester.

9. Poetry Prior to the Nineteenth Century.

PROFESSOR BATES

This course affords a brief introductory view of Anglo Saxon literature (in translation), a discussion of medieval romances and ballads, and a study of Elizabethan lyrics, Spenser, Milton, the Augustans, and the forerunners of romanticism in the eighteenth century.

3 hrs., first semester. 3 units.

10. Poetry of the Nineteenth Century.

PROFESSOR BATES

This course gives opportunity for the study of the following writers: Wordsworth, Coleridge, Scott, Byron, Shelley, Keats, Landor, Tennyson, Mrs. Browning, Robert Browning, Arnold, Rossetti, Morris, and Swinburne. Weekly papers on assigned topics, lectures, and discussions.

3 hrs., second semester. F, 8. 3 units.

13, 14. Chaucer.

MISS LUTRELL

In this course a large part of the *Canterbury Tales* is read, the *Prologue to the Legende of Gode Wommen*, and some of the minor poems. The course is purely literary and a knowledge of Anglo-Saxon is not required.

3 hrs., both semesters. 3 units, each semester.

15, 16. Nineteenth Century Fiction.**PROFESSOR BATES**

Lectures upon the lives and general position of the following authors: Austen, Scott, Dickens, Thackeray, Emily Bronte, Charlotte Bronte, George Eliot, Reade, Meredith, Hardy, and Stevenson. One work is read from each of these writers, and its intellectual substance, literary style, plot, characterization, and atmosphere are discussed.

2 hrs., both semesters. Tu Th., 8:30-9:25. 2 units, each semester.

17, 18. Contemporary Literature.**PROFESSOR BATES**

The aim of this course is to afford such a study of British and American literature in the last quarter-century as will enable the student to form a clear estimate of present-day tendencies. It covers the decadent and symbolic schools of British poetry, the Irish movement, contemporary American poetry, the romantic and realistic schools of fiction, and the revival of the drama, with especial reference to the influence of Ibsen. Readings assigned in the poetry of James Thompson, Francis Thompson, Lowson, Symons, Henley, Johnson, Yeats, Hovey, and Carman; in the fiction of Kipling, Hewlett, Gissing, Locke, and Herrick; in the dramas of Ibsen, Pinero, Jones, Shaw, Wilde, and Phillips. Lectures upon these and other authors.

2 hrs., both semesters. Tu Th, 11:15-12:10. 2 units, each semester.

19, 20. Principles of Literary Criticism.**PROFESSOR BATES**

The course is designed to enable the student from his examination of critical theory to form satisfactory canons of taste. In the first semester the following authors are studied: Plato, Aristotle, Sidney, Dryden, Addison, Pope, Johnson, and Burke. The second semester is devoted to writers of the nineteenth century, especially Wordsworth, Coleridge, Shelley, Hazlitt, Poe, Arnold, Pater, and various contemporary critics.

2 hrs., both semesters. 2 units each semester.

21, 22. Methods of Teaching English.**MISS PERRY**

This course is intended for students preparing to teach English in secondary schools. It will include: methods of teaching grammar,

rhetoric, composition, literature; discussion of the college entrance requirements in English; the blocking out of courses, and the planning and presenting of single lessons.

3 hrs., both semesters. M W F, 10:20-11:15. 3 units, each semester.

*23, 24. Greek Influences upon English Literature.

PROFESSOR BATES

The first semester will be mainly devoted to a study of the Greek spirit as manifested in their literature, art, and institutions, the second to a study of the influence of this spirit upon English literature as seen in the Elizabethan, Augustan and Romantic periods. Knowledge of Greek is not required.

3 hrs., both semesters. M W, 10:20-11:15. 2 units, both semesters.

*25, 26. Hebrew Influence upon English Literature.

PROFESSOR BATES

The first semester will be mainly devoted to a study of the Hebrew spirit as manifested in their literature and institutions, the second to a study of the influence of this spirit upon English literature as seen especially in the masterpieces of English prose. Knowledge of Hebrew is not required.

2 hrs., both semesters. Tu Th, 10:20-11:15. 2 units, each semester.

FRENCH

PROFESSOR TURRELL

1, 2. Elementary French.

First semester: Fraser and Squair, *French Grammar*, (Part I), Aldrich and Foster, *French Reader*. Second semester: Reading of Daudet, *La Belle Nivernaise*, Labiche and Martin, *La Poudre aux Yeux*, Halevy, *L'Abbé Constantin*. Composition and dictation, with drill on the irregular verbs.

5 hrs., both semesters. M Tu W Th F, 8:30-9:25. 4 units, each semester.

*Courses 23, 24 and 25, 26 to be given in alternate years.

3, 4. Advanced French.

PROFESSOR TURRELL

First semester: Fraser and Squair, *French Grammar* (Part II), Merimée, *Colomba* or *Carmen*, Lamartine, *Graziella*, Sand, *La Mare au Diable* or *La Petite Fadette*. Second semester: Selected reading: including Canfield, *French Lyrics*, Victor Hugo, *Les Misérables* (abridged).

5 hrs., both semesters. M Tu W Th F, 11:15-12:10. 4 units, each semester.

*5. French Literature to the Nineteenth Century.

PROFESSOR TURRELL

The classical French dramatists. Reading of plays of Corneille, Racine and Moliere. Lectures on the eighteenth century. Voltaire, Rousseau, Diderot, etc. Beaumarchais, *Le Barbier de Séville*. Library readings.

3 hrs., first semester. 3 units.

*6. French Literature in the Nineteenth Century.

PROFESSOR TURRELL

Particular study of the drama. The Romanticists, Victor Hugo, Musset, Scribe, Augier, etc. Recent literary movements in France. Pailleron, Dumas, Rostand, Zola, Sardou, Hervieu, Maeterlinck, etc.

3 hrs., second semester. 3 units.

*7, 8. Advanced Composition.

PROFESSOR TURRELL

Vreeland and Koren, *French Syntax and Composition*, Korn, *French Daily Life*, etc. Original essays and reports in French.

2 hrs., both semesters. Tu Th, 1:00-1:55. 2 units, each semester.

Courses 5, 6, 7, 8 may be taken together or separately, but must be preceded by courses 1, 2, 3, 4.

GEOLOGY

PROFESSOR TOLMAN AND ASSISTANT

The earlier courses in geology are constructed not only to introduce the student to general and applied geology, but with special reference to the development of the observational faculties, and training in in-

*Will be omitted in 1911-1912 on account of Professor Turrell's absence on leave.

ductive and deductive reasoning so that the student may discover for himself the causes for each phenomenon observed. The more advanced courses are technical and cover the essentials of geology for a mining engineer. The courses in geological mapping allow the student to take advantage of the opportunities at hand for field work, and include reconnaissance and detailed field mapping and underground geological mapping. Special field work can be undertaken by advanced students under the direction of the department.

1, 2. General Geology.

PROFESSOR TOLMAN

Geological processes, their causes and effects. The atmosphere, surface and underground water, the ocean and the ice and snow as geological agents. Earth movements; mountain and continent building; vulcanism. Rocks, their origin and alterations. Historical geology, reviewing the physical history of the earth and correlated life progress. Summary of the general principles of ore deposits.

The laboratory work covers the reading and interpretation of topographical and geological maps, the fundamentals of geological mapping, structural problems, and stereogrammatic and graphic methods for the solution of problems in faulting. Classification and laboratory study of rocks. Short field trips are taken in the second semester. Open to students who have taken Mineralogy 1.

3 hrs., and one laboratory period, both semesters. Tu W Th, 7:35-8:30; M, 9:25-10:20. 4 units, each semester.

3. Economic Geology—Non-Metallic Products. PROFESSOR TOLMAN

Statistics, production, utilization, value, occurrence, genesis and methods of investigation of iron and manganese and the non-metallic products, viz.: coal, gas, bitumen, etc.; building stones, clays, cement materials, sands, etc.; borax, phosphates, fluorspar, gypsum, graphite, mica, asbestos, mineral paints, etc.; salines, mineral waters, artesian flows, and investigation of underground water flow, etc.; precious stones.

3 hrs., first semester. Tu W Th, 9:25-10:20. 3 units.

4. Economic Geology—Metallic Products. PROFESSOR TOLMAN

Detailed study of ore deposits. Prerequisite, Geology 1, 2.

3 hrs., second semester. Tu W Th, 9:25-10:20. 3 units.

5, 6. Field Geology. PROFESSOR TOLMAN AND ASSISTANT

Construction of maps and sections. United States Geological Survey methods of geological mapping. Geological mine mapping and stereography. Two detailed geological maps are required of each student, one of a portion of the Tucson mountains (lava flows) and one of a district in the Rincon mountains (faulted and folded sedimentary rocks), a sketch reconnaissance map, and a geological map of mine workings. Open to students who have taken or are taking Geology 3, 4 and Mineralogy 5, 6.

Lectures 2 hrs. a week during October. First field trip October 27-November 11. Office work and report must be finished by the end of the semester. Second field trip March 1 to March 16, 1912. Office work and report due May 20. A third short trip of three days for the underground mapping of an ore body may be required at the discretion of the instructor. 4 units, each semester.

7. Type Fossils.

Identification of the type fossils, especially the Paleozoic.

2 hrs., first semester. 2 units.

Graduate Courses.

9, 10. Advanced Ore Deposits.

The study of the literature of special ore deposits or special problems in ore deposition, with microscopic work.

11, 12. Advanced Field Work.

The detailed study and mapping of a selected area, or of a selected ore deposit.

GERMAN**PROFESSOR TURRELL AND ASSISTANT****1, 2. Elementary German.**

First semester: Bacon, *German Grammar*, complete. Second semester: Reading of Storm, *Immensee*, von Hillern, *Hoher als die Kirche*, Manley and Allen, *Four German Comedies*. Composition, dictation and continued grammar drill.

5 hrs., both semesters. M Tu W Th F, 1:00-1:55. 4 units, each semester.

3, 4. Advanced German.

First semester: Pope, *German Composition*, with review of Syntax. Reading of Meyer-Foerster, *Karl Heinrich*, Heine, poems and *Die Harzreise*. Second semester: Composition continued. Lessing, *Minna von Barnhelm*, Schiller, *William Tell*, etc.

5 hrs., both semesters. M Tu W Th F, 10:20-11:15. 4 units, each semester.

5, 6. Lessing, Schiller, and Goethe. PROFESSOR TURRELL

First semester: Reading and interpretation of Lessing, *Emilia Galotti*, *Nathan der Weise*, Schiller, *Maria Stuart*, *Wallenstein*. Accompanied by a brief outline of German literature to the nineteenth century. Second semester: Geothe, *Hermann und Dorothea*, *Egmont*, *Die Italienische Reise*, *Faust*, Part I.

3 hrs., both semesters. M W F, 1:00-1:55. 3 units, each semester.
*7, 8. German Literature in the Nineteenth Century.

PROFESSOR TURRELL

First semester: The Romanticists and their successors. Class reading of Kleist, *Der Prinz von Homburg*, Grillparzer, *Der Traum ein Leben*, *Die Ahnfrau*, etc. Second semester: the rise of Naturalism and Symbolism. Wildenbruch, *Harold*, Fulda, *Der Talisman*, Sudermann, *Johannes*, Hauptmann, *Die versunkene Glocke*. Lectures and library readings.

2 hrs., both semesters. 2 units, each semester.

Note.—Courses 5, 6, 7, 8 may be taken together or separately, but must be preceded by Courses 1, 2, 3, 4.

GREEK

MRS. NEWSOM

1, 2. Beginner's Course.

MRS. NEWSOM

The work done is represented by White, *First Greek Book*; Goodwin, *Greek Grammar*; and Xenophon, *Anabasis* (first four books).

4 hrs., both semesters. M Tu W Th, 9:25-10:20. 4 units, each semester.

*Omitted 1911-1912 on account of Professor Turrell's absence on leave.

3, 4. Homer and Plato.

MRS. NEWSOM

Homer, *Iliad* (first four books); Plato, *Apology* and *Crito*; and selections from Lysias.

4 hrs., both semesters. 4 units, each semester.

HISTORY

PRESIDENT WILDE, PROFESSOR CHANDLER

In the work in history emphasis is placed on the social and political development, the relation of cause and effect, and the unity of history. The laboratory method is used whenever possible and individual work insisted on.

*1, 2. Expansion of the American People. PROFESSOR CHANDLER

A study of the political, social and economic development and expansion of the American people from the earliest settlement on the Atlantic seaboard down to the most recent political activities in the far West. The following subjects are given special attention: the transplanting of European peoples and institutions, and the adaptation of them to American conditions; the industrial evolution in the United States; the early western movement; the public domain; the development of American democracy; the great social and economic changes accompanying and following the civil war; the settlement of the far West. During the second semester considerable time will be given to the history of the Southwest and the study of its peculiar problems. Open to all college students.

3 hrs., both semesters. M W F, 9:25-10:20. 6 units.

3, 4. Mediaeval History.

PRESIDENT WILDE

A study of European history from the fall of the Roman empire to the close of the Protestant Reformation. A brief survey of the period extending to the French Revolution will connect the student with that course. The rise of institutions; the political, social, and economic life of the time; the influence of the church; the development of the modern state. The course gives a foundation for more intensive studies in history and provides a historical basis for the study of economics or other sciences.

3 hrs., both semesters. Hours to be announced. 6 units.

*Offered in 1911 and alternate years.

*5. The French Revolution and the Napoleonic Period.

PROFESSOR CHANDLER

The causes, events and results of the French Revolution, and the spread of reform under Napoleon. The study of the revolution will be prefaced by a review of the state of European civilization in the middle of the eighteenth century and the influence of the French and English schools of literature, philosophy and economics as factors in the political and economic revolutions. Open to all college students.

3 hrs., first semester. M W F, 1:55-2:50. 3 units.

*6. European History Since the Congress of Vienna.

PROFESSOR CHANDLER

A study of the liberal and reform movements, social, political, economic and intellectual, up to the present time; the evolution of constitutional government; the various movements towards national unity; the Franco-Prussian war; and the rise of Germany to a commanding position in world commerce and politics; English reform bills of 1832 and 1867, and other political, religious and social-industrial reforms. Open to all college students.

3 hrs., second semester. M W F, 1:55-2:50. 3 units.

7, 8. Constitutional History of the United States.

PROFESSOR CHANDLER

A detailed study of the formation of the Union and of the political and constitutional history of the United States, based on letters and speeches of American statesmen, public documents and special histories.

3 hrs., both semesters. M W F, 9:25-10:20. 6 units.

LATIN

MRS. NEWSOM

The courses below are open to students who have completed the first three years of Latin in the sub-collegiate department, or an equivalent. Constant thorough drills are given in technical grammar and prose composition. In reading, the matter is subjected to gram-

*Given in 1910-1911 and offered in alternate years.

matical, metrical, rhetorical and historical explanation. The study of the text is made the means of mental discipline, of developing the faculties of observation and critical judgment, and of acquiring habits of thoroughness and accuracy.

1, 2. Virgil, Livy, and Cicero. MRS. NEWSOM

Virgil, *Aeneid*, Books V and VI; Livy, Selections; Cicero, *de Senectute*, *de Amicitia*. Exercises in prose composition.

4 hrs., both semesters. M Tu W Th, 7:35-8:30. 4 units, each semester.

3, 4. Tacitus and Horace. MRS. NEWSOM

Tacitus, *Germania* and *Agricola*, Selections from Histories; Horace, *Odes*.

3 hrs., both semesters. 3 units, each semester.

MATHEMATICS

PROFESSOR GRIMES, ASSISTANT PROFESSOR MEDCRAFT

1a. Algebra. PROFESSOR GRIMES

An introduction to College Algebra. Prescribed for all B. S. courses.

3 hrs., first semester. M W F, 10:20-11:15. 3 units.

1b. Trigonometry. ASSISTANT PROFESSOR MEDCRAFT

Fundamental formulas of the plane trigonometry with applications to surveying. Prescribed for all B. S. courses.

2 hrs., first semester. Tu Th, 10:20-11:15. 2 units.

Students having had trigonometry may obtain college credit for the subject upon passing a satisfactory examination, provided such credit has not been used for entrance, otherwise the course must be taken again in class.

2. Analytical Geometry. PROFESSOR GRIMES

The fundamental methods of plane and solid analytical geometry. Prescribed for all B. S. courses.

4 hrs. and a 2-hr. laboratory period, second semester. M Tu W Th F, 10:20-11:15. 5 units.

2a. Advanced Algebra. PROFESSOR GRIMES

Continuation of Course 1a. Prerequisites: Mathematics 1a, 1b.

2 hrs., second semester. 2 units.

2b. Spherical Trigonometry. ASSISTANT PROFESSOR MEDCRAFT

Fundamental formulas and principles of the spherical trigonometry with applications to astronomy. Prerequisite: Mathematics 1b.

2 hrs., first semester. 2 units.

3. Differential Calculus. PROFESSOR GRIMES

The fundamental principles and formulae of the differential calculus, with their applications. Prescribed for sophomores in engineering courses.

4 hrs., first semester. M Tu W Th, 9:25-10:20. 4 units.

4. Integral Calculus. PROFESSOR GRIMES

The fundamental principles and formulae of the integral calculus, with their applications, including the use of tables of integrals. Prerequisite: Mathematics 3.

4 hrs., second semester. M Tu W Th, 9:25-10:20. 4 units.

4a. Advanced Calculus. PROFESSOR GRIMES

A supplementary course to Mathematics 4, giving especial attention to special methods of integration, and to the applications of the integral calculus to physics, mechanics, and other allied subjects.

2 hrs., second semester. 2 units.

5, 6. Analytical Mechanics. PROFESSOR GRIMES

The mathematical treatment of the fundamental principles of dynamics, statics. Prerequisites: Mathematics 4 and Physics 1, 2. Prescribed for all engineering courses.

4 hrs. and a 2-hr. laboratory period, first semester. 4 hrs., second semester. M, 7:35-9:25 (Math. 5 only), and Tu W Th F, 8:30-9:25 (Math. 5 and 6). 5 units, first semester; 4 units, second semester.

5a. Differential Equations. PROFESSOR GRIMES

A course in elementary differential equations with applications to physics, astronomy and mechanics.

2 hrs., first semester. 2 units.

MECHANIC ARTS

PROFESSOR HENLEY, MR. SNOW

The courses in Mechanic Arts comprise the elements of shop work and drawing. The work consists of lectures, recitations and drawing, tool and machine work. The courses are designed with special regard for the needs of the students in engineering, an effort being made to familiarize the student with the ordinary methods in shop work, a knowledge of which is valuable to every engineer, rather than to develop the skill of the mechanic.

1. Mechanical Drawing.**PROFESSOR HENLEY**

Elements of mechanical drawing, including lettering, tracing, and blue printing. The subject is treated in a purely mechanical way, the object being to enable the student to learn to make and read ordinary working drawings, and to give him some knowledge of ordinary drafting room practice.

2 3-hr. laboratory periods, first semester. W, 1:00-3:45; S, 9:25-12:10. 2 units.

2. Descriptive Geometry.**PROFESSOR HENLEY**

Elements of descriptive geometry, including problems in warped surfaces and intersection of solids.

1 lecture and 2 3-hr. laboratory periods, second semester. W, 11:15-12:10; W, 1:00-3:45; S, 9:25-12:10. 3 units.

3. Wood Shop.**PROFESSOR HENLEY**

Bench and machine work; elements of pattern and foundry work.

2 3-hr. periods, with occasional lectures, first semester. M Tu, 1:00-3:45. 2 units.

4. Forge Shop.**PROFESSOR HENLEY**

Forge work in iron and steel; tempering, case-hardening and annealing. A study of those characteristics of iron and steel which affect their working in the shop.

2 3-hr. periods, with occasional lectures, second semester. M Tu, 1:00-3:45. 2 units.

5, 6. Machine Shop.**PROFESSOR HENLEY**

This course includes the elements of machine shop practice, and the

erection and care of machinery. The student is given work on the drill press, shaper, lathe, and planer, as well as at the bench, and on the erecting floor. Only the ordinary classes of work are taken up, the object being to make it as much as possible, a general engineering course. Open to students who have had courses 1, 3, 4 or an equivalent.

2, 3, 4 or 5 3-hr. periods, both semesters. Th F, 1:00-3:45. 2, 3, 4 or 5 units, each semester.

8. Carpentry.

MR. SNOW

A course in wood work, including framing, joining, care of tools, etc.

2 3-hr. periods, second semester. M Tu, 1:00-3:45. 2 units.

9. Forge and Metal Work.

MR. SNOW

Forge work in iron and steel, pipe work, drill press, and care of small machinery.

2 3-hr. periods, first semester. M Tu, 1:00-3:45. 2 units.

MECHANICAL ENGINEERING

PROFESSOR HENLEY AND MR. SNOW

The work in Mechanical Engineering deals primarily with the design, construction or operation of machinery. The course includes a study of mathematics and of such sciences as are of value to all engineers, together with a certain amount of work in the other engineering departments. An effort is made to harmonize the work as much as possible with the actual conditions in practice.

1, 2. Mechanisms and Elements of Machine Design.

PROFESSOR HENLEY

Theory and design of linkages, gears, cams, screws, and other machine elements.

2 3-hr. periods, both semesters. F, 9:25-12:10; W, 1:00-3:45. 2 units, each semester.

3. Heat Engines.

PROFESSOR HENLEY

Principles of thermodynamics as applied to steam and internal combustion engines. Testing and operation, steam and gas engines, boilers, etc.

2 hrs. and 1 3-hr. laboratory period, first semester. W, 10:20-11:15; F, 11:15-12:10; F, 1:00-3:45. 3 units.

4. Pumping Machinery. PROFESSOR HENLEY

A study of the various types of pumps and compressors, and their efficiencies under different conditions.

2 hrs. and 1 3-hr. laboratory period, second semester. W, 10:20-11:15; F, 11:15-12:10; F, 1:00-3:45. 3 units.

5, 6. Machine Design. PROFESSOR HENLEY

Design, largely empirical, of various tools or machine parts.

2 3-hr. drafting periods, both semesters. M, 9:25-12:10; Tu, 10:20-12:10. 2 units, each semester.

7, 8. Mechanical Laboratory. PROFESSOR HENLEY

Testing of different types of engines, boilers, pumps, injectors and other machinery. Inspection of power plants and machinery installations.

2 3-hr. laboratory periods and 1 3-hr. computation period, both semesters. 3 units, each semester.

9, 10. Engine Design. PROFESSOR HENLEY

Design of the main features of a steam or gas engine, pump or compressor, with the completion of as much of the working details as time permits.

2 3-hr. drafting periods, both semesters. 2 units, each semester.

12. Power Plants. PROFESSOR HENLEY

A study of the economic design and operation of power and pumping plants. Problems involving the selection of machinery to perform a given duty with a probable minimum expense.

2 hrs., second semester. 2 units.

14. Small Power Plants and Pumping Machinery.

PROFESSOR HENLEY AND MR. SNOW

An abridged course in small machinery installations, dealing with the problems met with in ordinary small pumping plants. This course is designed for students in agriculture, and is made as non-technical as possible.

2 hrs. and 1 3-hr. elective laboratory period, second semester. Tu Th, 9:25-10:20; Th, 10:20-12:10. 2 or 3 units.

16. Seminar.

PROFESSOR HENLEY OR MR. SNOW

Discussion of various subjects which arise in connection with the work and the review of current engineering literature.

1 hr., second semester. Th evening. 1 unit.

METALLURGY

PROFESSOR GOODRICH

1. Introduction to Metallurgy. PROFESSOR GOODRICH

Physical properties of metals, alloys, thermal treatment of metals, thermal measurements, fuel, refractory materials, metallurgical processes, furnaces, thermo-chemistry, metallurgy of iron and steel.

Lectures, 1 hr., first semester. W, 11:15-12:10. 1 unit.

2. Fire Assaying. PROFESSOR GOODRICH

Fire assay for gold, silver and lead. Bullion assays. Prerequisite, Chemistry 3, 4.

Three 3-hr. laboratory periods, second semester. (March, April, May.) M T W, 1:00-3:45. 2 units.

3. Metallurgy of Gold and Silver. PROFESSOR GOODRICH

Stamp milling, chlorination, tube-milling, and filtering, cyaniding, pan-amalgamation; Patio, and Tina processes; hyposulphite leaching practice, etc. Lectures. Prerequisite, Metallurgy 1, 2, 7. 3 hrs., first semester. Tu Th F, 11:15-12:10. 3 units.

4. Metallurgy of Lead and Copper. PROFESSOR GOODRICH

Sampling, receiving, purchasing, roasting; blast furnace methods, reverberatory furnace methods; pyritic smelting, converting, desilveration of base bullion, electrolytic refining, hydro-metallurgy of copper, etc. Lectures. Prerequisites, Metallurgy 1, 2, 7.

4 hrs., second semester. Tu W Th F, 10:20-11:15. 4 units.

5a. Metallurgical Laboratory. PROFESSOR GOODRICH

Amalgamation, cyaniding, chlorination, hyposulphite lixiviation, etc., tests, together with mill work. This course runs parallel with Metallurgy 3. Lectures.

1 3-hr. laboratory period, first semester. W, 1:00-3:45. 1 unit.

5b. Metallurgical Laboratory.

Sampling, concentration, mill work. This course runs parallel with Metallurgy 7. Lectures.

1 3-hr laboratory period, first semester. F, 1:00-3:45. 1 unit.

6. Metallurgical Laboratory Thesis Work. PROFESSOR GOODRICH

The student will take up original problems in the treatment of ores, making a series of experiments to determine the best method of treatment. The equipment now is as complete as some of the best commercial ore testing plants, and new machinery is constantly being added.

2 3-hr. laboratory periods, second semester. Time to be arranged. 2 units.

7. Ore Dressing. PROFESSOR GOODRICH

Breaking, crushing, separating, concentrating, sampling; mill processes and management. Lectures and recitations. Prerequisite, Metallurgy 2.

3 hrs., first semester. Tu W F, 10:20-11:15. 3 units.

8. Metallurgy of Rare Metals. PROFESSOR GOODRICH

Metallurgy of zinc, cadmium, nickel, mercury, bismuth, tin, antimony, cobalt, platinum, tungsten, molybdenum. Lectures. Prerequisites, Metallurgy 1, 2 and 3.

2 hrs., second semester. 2 units.

9. Excursions. PROFESSOR GOODRICH

On the completion of the various subjects, trips will be taken to suitable plants, in order to study practically the metallurgical operations. The student thus is enabled to reap the advantage of our location—central in a great metallurgical field.

10. Concentrator and Smelter Design. PROFESSOR GOODRICH

This course is a practical metallurgical problem, such as may confront the student on entering practical work. The student may design the plant to suit the ore tested in Met. 6 Course.

2 hrs. and one 3-hr. drafting periods, second semester. M, 8:30-11:15; W F, 8:30-9:25. 3 units.

MINERALOGY
PROFESSOR GUILD

The main object of the courses in mineralogy is to familiarize the student with facts and methods that will enable him to determine the character of an ore or mineral by observation of its physical properties and by the performance of a few simple tests with the blow-pipe, since in the field and mine recourse can not usually be had to a well equipped chemical laboratory.

1. Determinative Mineralogy and Blow-Pipe Analysis.

Laboratory work with occasional recitations. Text-book: Brush and Penfield, *Determinative Mineralogy and Blow-Pipe Analysis*. Prerequisite, Chemistry 2.

Two 3-hr. laboratory periods, first semester. Th F, 1:00-3:45. 2 units.

3. Elementary Crystallography.

Two lectures or recitations per week. Prerequisite, Physics 2. M W, 11:15-12:10. 2 units.

4. Descriptive Mineralogy.

Lectures and recitations on the mode of occurrence, uses and classification of minerals. The study of a large number of hand specimens of minerals. Text-book: Dana, *A Text-book of Mineralogy*. Prerequisites, Geology 1, Mineralogy 1 and 3.

3 lectures, 1 laboratory period, second semester. M W F, 11:15-12:10; F, 1:00-3:45. 4 units.

5. Optical Mineralogy.

With microscopic study of the rock-forming minerals. Prerequisites: Geology 2, and Mineralogy 4.

2 hrs., or an equivalent, first semester. Tu W, 1:00-3:45. 2 units.

6. Petrography.

The preparation of thin sections of rocks for microscopic study, and the study of a type selection of rocks. Prerequisite: Mineralogy 3.

2 hrs., or an equivalent, second semester. Tu W, 1:00-3:45. 2 units.

7. Crystallography.

The measurement, projection and drawing of crystals. Prerequisite: Mineralogy 1.

Either semester. Tu W, 1:00-3:45. 2 or 4 units.

MINING ENGINEERING

PROFESSOR TOLMAN AND ASSISTANT

In this course attention is largely directed to the operations and economics of mining, and the laboratory and drafting work is so arranged that the student will have plans and designs which will be of value in the practice of the profession.

1, 2. General Mining.

Study of explosives and blasting, air compressors and air compression, air drills, drilling and boring, mine timbering, ventilation, transportation and hoisting of ore, mining machinery and its installation, surface improvements around mines.

2 hrs., both semesters; prerequisite: Geol. 1, 2, 9. M W, 8:30-9:25. 2 units, each semester.

3, 4. Laboratory in Mining.

The study of designing of timbering, and mining construction of all kinds, ore bins, heat-frames head-gear, dumping devices, etc.

One 3-hr. laboratory period, both semesters. Th, 8:30-11:15. 1 unit, each semester.

5, 6. Lectures on Mining Methods and the Economics of Mining.

PROFESSOR TOLMAN

5. The detailed analysis of placer, open cut and underground mining methods.

1 hr., first semester. Tu, 8:30-9:25. 1 unit.

6. Economics of mining, and a summary of mining law.

1 hr., second semester; prerequisite: Geol. 1, 2, 4. Tu, 8:30-9:25. 1 unit.

Note.—All students in Mining Engineering are required to put in a minimum of one hour a week for each unit taken in the Mining Engineering courses, in the preparation of a card catalogue and summary of current technical literature on mining. These cards will be examined every week by the department.

7. Practical Mining. Before entering upon the work of the senior year, all students who are candidates for the degree of B. S., in Mining Engineering, must have spent at least four weeks in practical underground mining. The fulfillment of this requirement must be evidenced by the certificate of the mine superintendent or foreman, and by notes and sketches of the processes observed, to be presented to the faculty of the School of Mines, and discussed with them.

8. Summer School of Mine and Topographical Surveying.

A 4-weeks course in the field during which detailed mine surveys will be carried out. The course will be given during the month of June, and in the northern part of the Territory where the high elevation makes the summer climate delightful. Required of all students taking the degree of B. S. in Mining Engineering, after June, 1912, unless the equivalent of actual underground surveying is offered. This course should be taken preferably at the close of the sophomore year. Open to students who have taken Civil Engineering 1, 2.

9. Field Excursions.

In connection with the courses in mining engineering, trips will be made to mining districts in Arizona and Sonora, usually one or two weeks in March or April. These trips are required of all candidates for the degree of B. S. in Mining Engineering.

The purpose of these trips is to afford the student an opportunity for close study and inspection of mining and metallurgical plants, and of rock formations and of minerals of commercial value. The students are accompanied by members of the faculty, and every effort is made to make the trips of the greatest practical value. The visits are carefully scheduled and notes, with sketches, measurements and photographs are taken, and elaborated into comprehensive reports by each student after the return.

During April, 1910, the mining districts and the reduction plants of Globe, Miami, and Ray were visited in this way. The thanks of the University are due the managers and superintendents of the various mining companies for their efforts and care in acquainting the students with the work under their management.

PHILOSOPHY AND EDUCATION

MRS. STANLEY

1, 2. History of Philosophy.

MRS. STANLEY

A study of the basal concepts and fundamental problems of philosophical thought as developed historically. Lectures, recitations and assigned reading. Text-books: Schwegler's *History of Philosophy*; Calkins, *The Persistent Problems of Philosophy*. Open to Juniors and Seniors.

3 hrs., both semesters. M W F, 8:30-9:25. 3 units, each semester.

*3. Psychology.

MRS. STANLEY

A special consideration of the subject as applied to teaching. Lectures, recitations and collateral reading. To be taken in the Sophomore year. Text: Angell's *Psychology*.

2 hrs., both semesters. Tu Th, 11:15-12:10. 2 units, each semester.

4. Pedagogy.

MRS. STANLEY

An account of educational evolution, both as a culture fact in the history of civilization and as a foundation for professional work; lectures, giving a brief but comprehensive outline of school systems, a special study of leading educators such as Comenius, Pestalozzi, Froebel, Mann, and others. Arrangements have been made with the Tucson city schools to provide practice work for this class. Open to students who have taken Philosophy 1.

2 hrs., both semesters. Tu Th, 7:35-8:30. 2 units, each semester.

*5. Logic.

MRS. STANLEY

Text-book, Jevons' *Logic*; reading from Mill, Hamilton, Thompson and others. Open to Juniors and Seniors.

4 hrs., first semester. M W Th F, 9:25-10:20. 4 units.

*6. Ethics.

MRS. STANLEY

Theoretical and practical ethics; view of the historical development of the science; origin and development of the moral conscious-

*Omitted 1910-1911.

ness; application of the principles of ethics to the problems of life. Lectures, discussions and assigned reading. Text: Dewey and Tufts' *Ethics*. Open to Juniors and Seniors.

3 hrs., second semester. M W F, 9:25-10:20. 3 units.

7, 8. Philosophical Problems in Great Books. **MRS. STANLEY**

A comparative study of interpretations of life as revealed in masterpieces of the world's literature.

This course is designed to meet the needs of students who cannot afford the time for advanced English or philosophy, as well as to supplement the course now offered in those departments. The programme as planned will include ten great books, viz.: *The Antigone of Sophocles*; *The Apology of Socrates*; *The Book of Job*; Dante's *Divine Comedy*; *Les Misérables*; *Faust*; Tolstoi's *Anna Karenina*; Ibsen's *Peer Gynt*. Lectures and interpretative readings. Open to Juniors and Seniors.

1 hr., both semesters. Tu, 9:25-10:20. 1 unit, each semester.

PHYSICAL TRAINING

MR. KLEEBERGER

The department of physical training has general direction of the gymnastic and athletic activities of the University. The department aims to give the students such exercises, games, and sports as will best create and maintain a vigorous physical health, and to this end it strives to reach as many persons as possible, especially the weak and, undeveloped, and to give to each one exercise that will at once benefit, interest, and stimulate him. Physical training is prescribed for all freshmen and sophomores from October 1st to May 15th. With the approval of the director of the gymnasium, students may substitute some form of regular athletic work for the course in the gymnasium for specified periods.

A. Physical Examination for Men.

MR. KLEEBERGER

The examination includes about thirty measurements of the body, tests of strength, and examination of the heart, lungs, and other vital organs, together with inspection for marks of vaccination and physical inequalities. Prescribed for all freshmen and sophomores at the be-

ginning of the year or on entrance into these classes. A second examination is optional with the instructor, while a rigid and complete special examination by the University physician may be ordered at any time without expense to the student.

1, 2. Gymnastics and Hygiene for Men.

Setting-up exercises, calisthenic drills, indoor games, and simple apparatus work. Lectures on the physiology of exercise, personal hygiene and corrective exercises. Required of all freshmen unless excused on recommendation of the University physician.

2 half-hour periods, both semesters. 1-2 unit.

3, 4. Advanced Gymnastics.

A continuation of the work of the first year; the use of apparatus, parallel bars, horizontal bar, horses, rings, out-door runs, etc. When possible the class will be divided into graded sections for special work on the apparatus. Required of all sophomores unexcused by the University physician.

2 half-hour periods, both semesters. 1-2 unit.

5, 6, 7, 8. Gymnastics for Women.

The work is prescribed for young women as for men, and resembles that for men in its general scope and aim. It is, however, modified to suit the needs of the young women, emphasis being laid upon poise, carriage, grace, and development. Music is used for class drills, marching, and dancing. A gymnasium suit is necessary, consisting of a loose blouse waist, divided skirt, and the regular gymnasium shoes. The waist has a sailor collar trimmed with white braid. Four yards of double width, 54-inch dark blue serge is required. Ready-made suits may be purchased for about \$4 at the gymnasium. Required of freshmen and sophomores.

3 half-hour periods each semester. 2 units.

B. Football, Baseball, Basketball, Tennis, and Field and Track Work.

Recreative sports as a relaxation from study and as a means of development are recognized by the University in its provisions of fields, courts, etc., and by its acceptance of time devoted to such sports, with the approval of the director of the gymnasium, as satis-

faction for part of the requirements in physical training. Save for the traditional seasons fixed for these sports by climatic conditions in other regions, they might all be indulged in throughout nearly the whole academic year, as is the case with tennis. The direct control and management of these sports and the competitive games with outside teams, are vested in the Athletic Association of the University of Arizona, made up of both students and faculty, but officered by students. During the current year, contests have been held with the Agricultural College of New Mexico in football; with the Tempe Normal School in Tempe and in Tucson, in track and tennis; and with the Tucson high school in baseball, basketball and tennis.

PHYSICS

PROFESSOR DOUGLASS

The object of this course is to acquaint the student with the fundamental physical principles which underlie the higher courses of chemistry, mechanics and engineering. Note books are required in all courses.

1, 2. General Physics.

PROFESSOR DOUGLASS

Lectures, recitations and laboratory work. First semester: Mechanics and heat. Second semester: Electricity, wave motion, sound and light. The laboratory experiments give prominence to general electrical measurements, but include the study of wave motions and their application to the other subjects. Prerequisites: A course in elementary physics and mathematics 1.

2 hrs., and two 2-hr. periods in the laboratory, both semesters. M W, 10:20-11:15; Tu Th, 10:20-12:10. 4 units, each semester.

3. Thermodynamics and Heat.

PROFESSOR DOUGLASS

A study of the foundation principles underlying mechanical engineering, latent and specific heats, conductivity, expansion, mechanical equivalent, high temperatures, cycles, entropy, properties of steam, etc. Prescribed for third year in mechanical engineering course.

1 hr. and two 3-hr. periods, first semester. F, 10:20-11:15; M F, 1:00-3:45. 3 units.

4. Electrical and Optical Measurements. PROFESSOR DOUGLASS

A study of the electrical machines and instruments used in mechanical engineering, and of the optical instruments handled in mining and civil engineering courses. Prescribed for the third year in mechanical and civil engineering courses.

1 hr. and two 3-hr. periods, second semester. 4 units.

SPANISH**PROFESSOR TURRELL****1, 2. Elementary Spanish.**

First semester, Hills and Ford, *Spanish Grammar*; Turrell, *Spanish Reader*, begun. Conversation and oral work. Second semester: Grammar and reader completed; additional readings with composition and dictation.

5 hrs., both semesters. M Tu W Th F, 11:15-12:10. 4 units, each semester.

3, 4. Advanced Spanish.

First semester: Reading of Johnson, *Cuentos Modernos*; Alarcón, *El Capitan Veneno*. Second semester: Galdós, *Marianela*; Valdes, *La Alegria del Capitan Ribot*, etc. Three hours each week during the first semester and two hours during the second will be given to composition, letter writing and syntax, using Umphrey, *Spanish Composition*, and Bonilla, *Spanish Daily Life*.

5 hrs., both semesters, M Tu W Th F, 8:30-9:25. 4 units, each semester.

5. Spanish Literature to the Nineteenth Century.*PROFESSOR TURRELL**

Lectures in Spanish on the early literature of Spain, the "Siglo de Oro," etc., with library readings. Class study of Cervantes, *Don Quijote* (Selections); Lope de Vega, *La Estrella de Sevilla*; Calderón, *La Vida es Sueño*, etc.

3 hrs., first semester. M W F, 1:55-2:50. 3 units.

*Will not be given in 1911-12 on account of Professor Turrell's absence on leave.

*6. Spanish Literature in the Nineteenth Century.

PROFESSOR TURRELL

Particular study of the drama. Reading of Moratin, *El Si de las Ninas*; Larra, *Partir a Tiempo*; Gutierrez, *El Trovador*; Tomayo y Baus, *Lo Positivo*; Nunez de Arce, *El Haz de Lena*; Echegaray, *El Gran Galeoto*; Galdos, *Electra*.

3 hrs., second semester. M W F, 1:55-2:50. 3 units.

*7. General Survey of the Literature of the Countries of Spanish America.

PROFESSOR TURRELL

Class reading of Ugarte, *La Joven Literatura Hispano-americana*; Hills, *Bardos Cubanos*; Avellaneda, *Baltasar*, etc.

2 hrs., first semester. 2 units.

*8. History of Mexican Literature.

PROFESSOR TURRELL

Reading of works by the best authors, as included in the *Biblioteca de Autores Mexicanos*, etc.

2 hrs., second semester. 2 units.

9, 10. Advanced Spanish Composition and Commercial Spanish.

PROFESSOR TURRELL

A practical course in writing and speaking Spanish. Harrison, *Spanish Correspondence*; Remy, *Spanish Composition*, etc., will be used. Original essays, letters and reports in Spanish. (May be taken with courses 5, 6, but must be preceded by courses 1, 2, 3, 4.)

2 hrs., both semesters. 2 units, each semester.

ZOOLOGY

MR. BROWN

1. Invertebrate Zoology.

The development and anatomy of types of the various phyla of invertebrates. Text: Parker and Haswell, *A Manual of Zoology*.

Tu W Th, 1:55-3:45. 4 units.

2 hrs. of lectures and 6 hrs. of laboratory work, first semester. M

2. Vertebrate Zoology.

A continuation of course 1.

4 units.

*Not given in 1911-12, Professor Turrell being absent on leave.

3. Histology of the Animal Tissues.

Instruction is given in the theory and use of the microscope, the camera lucida, the photo-micrographic camera, the use of chemicals in the preparation of microscope slides. The course is primarily a laboratory course.

4 units.

SHORT COURSE IN AGRICULTURE

This course is offered, first, to meet the demands of prospective homeseekers who desire to learn something about the general principles and practices of irrigation farming before engaging in actual farm operations in Arizona. Second, to give the young man who feels that he can not afford the time or the means to pursue a full college course a brief introduction to some of the more important scientific principles and facts that are the basis of successful farming, before he settles down to his chosen business, as well as to give him a measure of that broad general culture that is always incidental to University life, and which makes so much for good citizenship. Third, to equip young men to take advantage of opportunities and to fill positions demanding more intelligence and skill than ordinary farm labor. Opportunities and positions for young men of such training are now open in Arizona and will become more frequent as the great reclamation projects being carried on are completed. As specific examples may be mentioned: First, the vast areas of desert land in Arizona that may be reclaimed by pumping, the development of which has scarcely been touched; but to make the most of such opportunities one will need more mechanical skill and more knowledge of the physical properties of soil than the average farmer possesses. Second, the University has recently had several calls for farm managers at salaries ranging up to \$150 per month, and expects such calls to increase in number. Courses in Irrigation, Engineering, Farm Management, Soil Physics, Vegetable Gardening, Orchard Management, and Farm Dairying, are especially designed to equip young men to take advantage of these opportunities and positions.

ADMISSION

Students will be admitted to the short course who have a general

knowledge of the common school branches and sufficient maturity in years to understand the value of their time and opportunity. They will be accorded the same privileges, and required to observe the same regulations, as other students registered in the University and resident upon the campus.

EQUIPMENT

The University is amply equipped with library, laboratory, and green-house facilities, while the development of a farm of 80 acres recently purchased will give opportunity for an abundance of practice in the application of the knowledge gained in the class room, library, laboratory and green-houses.

The following outline of the course of study indicates the scope of the work done. In addition to the time spent in the class room indicated below, students will be required to do a limited amount of work on the farm, for which they will be paid by the University.

SHORT COURSE IN AGRICULTURE

FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Agr. 3 (Live Stock Judging) .	3	Agr. 4, Dairying.....	3
Agr. 1 (Plant Culture).....	3	Agr. 2, Farm Crops.....	3
Agr. 15 (Poultry).....	3	Agr. 14, History of Breeds...	3
Mech. Arts 1 (Mechanical Drawing)	2	Mech. Arts 8 (Carpentry)...	2
Mathematics or English.....	5	Mathematics or English.....	5

SECOND YEAR

Mech. Arts 9 (Forge and Metals)	2	Mech. Eng. 14, Small Power Plants and Machinery.....	2
Civ. Eng. 19 (Surveying)....	3	Civ. Eng. 20 (Irrigation)....	3
Botany I	4	Botany III	4
Agr. 5 (Market Gardening) .	3	Agr. 12 (Citrus Fruits)....	4
Agr. 9 (Soil Physics).....	4	Agr. 16 (Feeds and Feeding) .	3

For a description of these courses see pages 55 to 61.

AGRICULTURAL EXPERIMENT STATION STAFF

ARTHUR H. WILDE, Ph. D., President of the University.

ROBERT H. FORBES, M. S., Director and Chemist.

JOHN JAMES THORNBERRY, A. M., Botanist.

ALBERT E. VINSON, Ph. D., Biochemist.

WILLIAM H. ROSS, Ph. D., Assistant Chemist.

FREDERICK W. WILSON, B. S., Animal Husbandman.

G. E. P. SMITH, C. E., Irrigation Engineer.

FRANK C. KELTON, B. S., Assistant Engineer.

ROBERT W. CLOTHIER, M. S., Agriculturist.

ALEXANDER M. McOMIE, B. S., Assistant Agriculturist.

GEORGE F. FREEMAN, B. S., Plant Breeder.

CHARLES H. CLARK, B. S. A., Assistant Agriculturist.

AUSTIN W. MORRILL, Ph. D., Entomologist.

E. DANA TROUT, Secretary.

ORGANIZATION AND WORK

The Agricultural Experiment Station is a legally constituted department of the University, whose purpose is to aid "in acquiring and diffusing * * * useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science."

With the above objects in view the organization of the station includes the departments of administration, agriculture, horticulture, animal husbandry, botany, plant breeding, chemistry, and irrigation investigations, the whole or a major portion of the time of one or more members of the station staff being devoted to each department of the station work. Provision is made for meteorological work also, though to a less degree.

Owing to the wide variation in agricultural conditions in Arizona, it has been found of advantage to distribute the work so that each department is located, so far as possible, in that region most favorable to the accomplishment of its own special results. According to this

principle, the various lines of Experiment Station work have been distributed as follows:

The Director's office and the departments of botany, plant breeding, chemistry, and irrigation investigations are maintained at Tucson in the University buildings. It has been found that from this base of operations the three great agricultural districts of the Territory—Salt River Valley, the lower Colorado, and the upper Gila—are accessible with equal convenience for field work and observations.

On the same ground—fitness of location for the work undertaken—the Experiment Station Farm has been maintained and strengthened at Phoenix. Salt River valley is intermediate in elevation, in situation, and in mean yearly temperature, between the other two important farming districts above mentioned, and for this reason the agricultural and horticultural results obtained there are capable of the most general application in the Territory at large.

On the same principle again, the date palm orchard, conducted in co-operation with the United States Department of Agriculture, is located in the alkaline district south of Tempe, where a successful demonstration of this palm as a commercial fruit producer will be of the greatest value, creating use for great areas of alkaline land in the arid southwest.

The demonstration farm near Yuma, in the fertile Colorado valley bottom, has likewise afforded a succession of object lessons to the public of that locality, as well as much needed information concerning crops, agricultural methods and markets for that rich region.

Experiments in dry-farming have been undertaken on tracts in the Sulphur Springs Valley, between Willcox and Douglas, and in the neighborhood of Snowflake in Navajo County, in localities typical of large areas.

The range station, also, for the study of worn-out range country with a view to its reclamation to usefulness, is conducted in a typical district near Tucson, and is conducted under the auspices of the department of botany, co-operating with the United States Department of Agriculture.

The results of the Experiment Station work are made public at

frequent intervals in the bulletins and reports of the Station. These publications are made in two series: First, the longer and more technical bulletins, stating in considerable detail the investigations as they mature; and, secondly, the Timely Hints for Farmers, which are brief writings issued at the time when they will be most useful, written in plain language, and presented in popular form.

Along its several general lines of effort the Station during the eleven years ending with 1910 has issued 115 publications, exclusive of annual reports which contain much technical information of similar character. These publications may be classified as follows:

Soils, waters, alkali, and farm management.....	26
Climate	1
Crops	43
Weeds, insect pests and plant diseases.....	15
Irrigation	11
Animal industry and the range.....	19

When it is remembered that for years past the mailing list has enabled us to reach from forty to fifty per cent of the farming population of the Territory, it is not surprising that the effects of Station work are now generally in evidence, more particularly in our irrigated southern valleys.

Continuing with former appropriations the Twenty-Fifth Territorial Legislature set aside \$13,100 for the use of the Experiment Station for the biennium ending in 1911. This appropriation provides for printing, for Farmers' Institutes, for dry farming experiments, for the maintenance of the date orchard at Tempe. Supplementing the Federal funds, therefore, provision is made for the symmetrical development of this work in the Territory, both experimentally and educationally; and, prospectively, "the farmer's college" bids fair to increase in usefulness to the growing agricultural interests of the Territory.

BUREAU OF MINES AND ASSAYING

A separate department of the School of Mines under the name of "The Bureau of Mines and Assaying" has been established to receive

and work ores, and to make assays and analyses of ores, minerals, mineral waters and petroleum.

In accordance with the Act of the Legislature of the Territory, approved March, 1897, and amended in March, 1899, assays of ores and minerals are made for the prospectors and miners of Arizona and for others at fixed rates established by the law, and tabulated below. To meet the requirements of this work a special laboratory building of brick has been erected and maintained. Qualitative determinations of the nature of samples are made free.

Extreme accuracy and excellence of work are considered of more importance than pecuniary profits. All assays are made in duplicate and if not accordant are repeated. The work of the Bureau is under the personal direction of the professor of metallurgy and a paid assistant; the assays are not made by students, who receive their instruction in the regular laboratories of the University.

The money received for assaying is deposited monthly to the credit of the assay fund which is used to pay the assayer and the cost of material and apparatus.

RATES FOR ASSAYING AND CHEMICAL DETERMINATIONS

COMMON ASSAYS AND CHEMICAL DETERMINATIONS

One element only:

Gold, or silver, or copper, or lead, or iron, or insoluble.....	\$ 1.00
Zinc, or calcium, or magnesium, or sulphur, or manganese.....	1.50
Silicon or chlorine	2.00

Combinations:

Gold and silver	1.00
Copper and iron, or lead and iron.....	1.50
Insoluble, copper, and lead	2.00
Insoluble, copper, and iron	2.00
Insoluble, lead, and iron	2.00
Insoluble, zinc, and iron	2.50
Insoluble, lead, copper, and iron	2.50
Gold, silver, copper, and lead	2.50
Gold, silver, copper, iron, and insoluble.....	2.50

SPECIAL CHEMICAL DETERMINATIONS

One element only:

Aluminum, or tungsten, or barium, or chromium.....	3.00
Cadmium, or tin, or arsenic, or bismuth, or antimony, or titanium, or sodium, or potassium, or uranium, or phosphorus..	4.00
Nickel, or cobalt, or molybdenum, or vanadium.....	5.00

CHEMICAL ANALYSIS

Coal and coke analysis, giving moisture, volatile combustible matter, fixed carbon and ash	5.00
The same, including determination of sulphur and phosphorus	7.50
Silicate analysis	15.00
Cement analysis (chemical)	15.00
Cement analysis (mechanical)	2.50
Cement tests for strength and soundness by the Department of Civil Engineering	5.00
Boiler water analysis	10.00

RATES FOR TESTING ORES

Stamp mill amalgamation, including sampling, assays, retorting, etc.:

For lots of one ton or thereabouts.....	\$30.00
The same, with concentration of pulp on Wilfley table.....	30.00
For lots of two tons, without concentration.....	40.00
For lots of two tons, with concentration.....	45.00

Smaller amalgamation tests, including all sampling charges, and concentration after amalgamation:

For small samples, up to five pounds.....	\$ 7.00
For small samples, five to twenty-five pounds.....	10.00
For small samples, twenty to one hundred pounds.....	15.00

In these smaller tests, the sample is ground to pass a suitable mesh, and is agitated with mercury. The mercury is panned out, retorted, and the values determined in bullion. The values in the concentrates and tailings are also determined. The number of tests necessary to determine the adaptability of any ore to treatment in cyaniding varies so greatly that no general rates can be offered.

CONSIGNMENTS, REMITTANCES, ETC.

Samples, ores, and other consignments should be shipped to the University of Arizona, the School of Mines, Tucson, Arizona. Small quantities may best be sent by mail, at the rate of one cent per ounce; larger quantities by express or by freight. The Wells Fargo Express Company makes daily deliveries at the University.

All assays, chemical determinations and chemical analyses, except gratuitous qualitative tests mentioned elsewhere, must be paid for in advance.

No determination of any kind will be made until the required payment arrives. Remittances should be made by postoffice money order, Wells Fargo money order, bank draft, or check on a Tucson bank, payable to Dr. A. H. Wilde, President, University of Arizona, to whom also business communications relating to matters discussed in this circular should be addressed.

PREPARATORY DEPARTMENT

FACULTY

1910-1911

- ARTHUR HERBERT WILDE, Ph. D., President.
FRANCES M. PERRY, A. M., Principal; English.
CHARLES A. TURRELL, A. M., French.
WILLIAM W. HENLEY, A. B., Shop Work and Drawing.
ANDREW ELICOTT DOUGLASS, D. Sc., Physics.
ROBERT W. CLOTHIER, M. S., Agriculture.
CAPT. HIRAM M. POWELL, Military Science and Tactics.
WILLIAM GEORGE MEDCRAFT, A. M., Mathematics.
RAYMOND C. BENNER, Ph. D., Chemistry.
LEVONA PAYNE NEWSOM, Ph. D., Latin and Greek.
FRANK LEWIS KLEEBERGER, B. S., Physical Training and Mathematics.
FREDERICK E. TALMAGE, B. L., Bookkeeping, Stenography, Typewriting.
IDA C. REID, Ph. M., Mathematics and History.
WILLIAM L. FOWLER, B. S., Animal Husbandry.
LOUISE M. PETERS, A. M., Spanish and German.
JOSEPHINE MACK, A. B., English.
ANGELA O'BYRNE, Music.

GENERAL INFORMATION

In this department the University offers the work of a well organized, four-year high school, with the added advantages of shop work and drawing, and military drill. The general library and gymnasium are open to all students in this department.

The equipment of the scientific laboratories is available for use in this preparatory work, whenever it can be used advantageously, and makes possible strong work in elementary science. The instructors in this department are assisted by the professors of the college departments, several of whom regularly conduct preparatory classes. By reference to the course of study which follows, it will be seen

that it offers a comprehensive training for those who may not be able to pursue their studies farther, while it gives a good preparation for college.

Admission to regular standing in the first year of the preparatory course presupposes the completion of the work of the eighth grade of the public or parochial schools. Students who do not bring certificates showing the completion of this work, must take examinations to test their ability to pursue profitably the work of the first year. Pupils who have not completed the work of the ninth grade (or the first year of a high school) will not be admitted into the University from cities in Arizona having more than 5,000 population.

All students entering the preparatory department will be required to take an examination in oral reading. To remedy notable deficiency in this subject, the University will require extra work in addition to other studies. In all cases in which the preparation of a student in a particular subject proves to be deficient, the University reserves the right to require the student to secure at his own expense the help of an approved coach until the deficiency is remedied.

LIVING ACCOMMODATIONS AND EXPENSES

A portion of South Hall is set apart for the use of male preparatory students; details of furnishings, living expenses, etc., are set forth in a paragraph earlier in this Register. These expenses are substantially the same for both college and preparatory students, save that laboratory fees and book bills are higher for the former. The expenses necessarily incurred during the academic year are about \$300, but of this amount nearly one-third falls due in the first month, or in the six weeks before November 1st, in the form of charges which are made but once during the year. The following are the estimated ordinary expenses for the first month:

Incidental fee	\$ 5.00
Mattress, blankets, pillows, sheets, etc., (unless brought from home by the students).....	15.00
Board for the first month.....	18.50
Books	6.00
Shop and Drawing fee	5.00

Military uniform	16.25
Student Associations (voluntary)	5.00
<hr/>	
	\$73.75

The dormitory is in charge of two resident instructors. Inspection of rooms is made in the morning and in the evening by the head of the dormitory. The hours from seven to quarter past nine in the evening are observed as study hours except on Fridays and Saturdays. Students under twenty-one years of age are required, unless relieved by the President, to obtain permission to leave the campus, or to leave the dormitory during study hours, except on Sundays from nine to twelve a. m., Wednesdays, four to seven p. m., and Fridays, four to six p. m. Breaches of the regulations of the dormitory are punished by "extra study"—labor about the buildings or grounds—by confinement to rooms, or by expulsion from the dormitory; for damage to University property, a money penalty is imposed.

COURSE OF STUDY

The following course of study will be required of all students who fit themselves at the University for entrance to the freshman class in 1912. Such variations from it will be permitted as will adapt it to the case of students who took part of their work in other schools.

Military drill is required of all able-bodied male students throughout the course. Physical training is required of all students, unless they are excused by the President upon presenting a certificate from one of the University physicians. The young men have drill three times a week and exercise in the gymnasium twice. The young women have physical culture three times a week.

Though the subjects are for convenience grouped by years in the following schedule, the departmental method is followed. In the description of courses, the subjects are arranged by groups or departments in the consecutive order in which they are taken up and students will be required to take them in this order. Aside from this sequence the ability of each student must determine what subjects will be pursued at any given time, due regard being given to the proper balance of subjects. The wishes of parents will always be

given careful consideration in making up the schedule of work for each student, but the final decision in the matter rests with the committee on registration, which is composed of persons who have had long experience in secondary and collegiate teaching. Individual attention will be given to the needs of each student.

A certificate is granted to students who have completed satisfactorily the work required for entrance to the Liberal Arts courses of the University.

Students who have completed the entrance requirements of a University course are admitted to that course without examination. The entrance requirements to the various University courses are repeated below for the convenience of the Preparatory student.

Admission requirements for Bachelor of Arts or Bachelor of Science:

English	3 units*	American History and Language other than Civics	1 unit
English	2 units	Science	1 unit
Mathematics	2½ units	Electives	5½ units

Total, 15 units

Admission requirements for Bachelor of Science in Agriculture are the same as the entrance requirements for the general B. S. degree, excepting that language, other than English, is elective.

(Admission to the short course in Agriculture is possible without previous high school work.)

Admission requirements for the Bachelor of Science in Engineering are as follows:

English	3 units	Mathematics	3 units
Language, other than English	2 units	Physics or Chemistry.....	1 unit
		Electives	6 units

Total, 15 units

For Mining Engineering both Physics and Chemistry are required, leaving only five electives.

The following distribution of work is required, unless, in the opinion of the registration officer, there is good reason for departing from it:

*A unit represents a subject pursued for one year with five or four recitation periods a week.

FIRST YEAR

English	5 hrs.	Greek and Roman History	3 hrs.
Algebra	5 hrs.	Physical Geography.....	3 hrs.
And ten or eleven hours from the following courses:		Language, not English.....	5 hrs.

SECOND YEAR

English	5 hrs.	European History	5 hrs.
Algebra	5 hrs.	Language, not English.....	5 hrs.
And any two of the following courses:		Bookkeeping	5 hrs.

THIRD YEAR

English	5 hrs.	*Languages, other than English, each	5 hrs.
Plane Geometry.....	5 hrs.	Stenography	5 hrs.
Chemistry	5 hrs.	One of 2nd yr. electives...5 hrs.	

FOURTH YEAR

American History and Civics	5 hrs.	Physics	5 hrs.
And any three of the following:		Languages, each	5 hrs.
English	5 hrs.	Mechanical Arts (Shop and Drawing)	5 hrs.

OUTLINE OF STUDIES

ENGLISH

The preparatory course in English is planned to give the student knowledge of the fundamental requirements of grammar and rhetoric, to make him acquainted with good literature, and to establish good habits in written and oral expression and in reading. The time is therefore divided between the study of composition and literature. The course covers the work mapped out by the National Conference on Uniform Entrance Requirements in English. The following description of courses will give an idea of the scope and character of the work:

*Since one language must be continued through two years to meet entrance requirements, the election of the first foreign language should not be delayed beyond the beginning of the third year.

FIRST YEAR

GRAMMAR: Scott and Buck, *A Brief English Grammar*.

COMPOSITION: The students are given constant practice in writing simple themes based on their own experience.

LITERATURE: For close study and class room discussion—Longfellow, *Hiawatha*; Scott, *Marmion*; Homer, *Odyssey*; Stevenson, *Treasure Island*; Burroughs, *Sharp Eyes*; Irving, *Sketch Book*. For supplementary reading—Longfellow, *Evangeline*; Scott, *Ivanhoe*; and *The Talisman*; Hale, *Man Without a Country*; Mark Twain, *Tom Sawyer*; Jack London, *Call of the Wild*; Wells, *War of the Worlds*.

SECOND YEAR

COMPOSITION AND GRAMMAR: The principles of composition applied to the sentence and the paragraph; choice of effective words; correct usage; figures of speech.

LITERATURE: For close study and class room discussion—Coleridge, *Ancient Mariner*; Lowell, *Vision of Sir Launfal*; Tennyson, *Idylls of the King*; George Eliot, *Silas Marner*; Shakespeare, *Julius Caesar*; Addison, *The Sir Roger de Coverley Papers*; Hearn, Kotto.

For supplementary reading—*Genesis and Exodus*; Scott, *Lady of the Lake*, *Kenilworth*; Blackmore, *Lorna Doone*; Irving, *Capt. Bonneville, or Tales of a Traveler*; Kingsley, *Westward Ho*; Dickens, *Oliver Twist*; Poe, *Short Stories*; Holmes, *Elsie Venner*.

THIRD YEAR

COMPOSITION AND RHETORIC: Principles of Rhetoric applied to structure of expository themes and informal argument; topical outlines; analysis of essays studied in class.

LITERATURE: Dickens, *David Copperfield*; Macaulay, *Essays on Addison and Johnson*; Wordsworth, *Short Poems*; Milton, *Short Poems*; Shakespeare, *Twelfth Night*, *Macbeth*; Spenser, *One Book of Faerie Queene*; Chaucer, *Prologue*.

FOURTH YEAR

A course in Public Speaking: Oral debates, formal and informal, based on briefs; analysis of speeches of Lincoln and Burke; parlia-

mentary usage; oral narration; digests of stories and personal adventures; after-dinner speeches; presentation speeches; and various kinds of occasional addresses.

MATHEMATICS

ALGEBRA. First year: Introduction, factoring, fractions, simple equations, simultaneous equations, and special problems. Second year: Involution, evolution, theory of exponents, radicals, quadratic equations, and proportion. The ground covered by these two years will be required for entrance to the engineering courses in college.

PLANE GEOMETRY. Third year: Emphasis is laid on thorough work in original exercises.

SOLID GEOMETRY. Second semester, fourth year, with original exercises.

MECHANIC ARTS

This work consists of both drawing and shop work, between which subjects the student's time is about equally divided. The course covers one year and is designed to furnish a thorough elementary knowledge of manual training as taught in the secondary schools of the country.

DRAWING. Freehand sketching in perspective and orthographic projection. Reinhart's lettering, freehand working drawings. Mechanical drawing and geometrical problems.

SHOP WORK. "Sloyd," care and use of woodworking tools. Forging, joinery, wood turning.

SCIENCE

It is the object of the courses in science to initiate the student into the processes and methods used in laboratory work; to teach close observation, careful manipulation and logical deduction; to acquaint the student with the fundamental facts of the various branches of science and to give full practice in the use of good English in describing various observations and experiments. To insure better results in the notebooks, they will all be passed upon by one of the instructors in English.

PHYSICAL GEOGRAPHY

This course, combining the laboratory method with the text-book,

aims to give the pupils training in exact observation of familiar phenomena, like distance, weight, pressure of liquids and gases, temperature, winds, clouds, and the habits of plants and animals. The natural forces producing erosion, formation of soil, and rocks, the processes of nature as seen in seed germination and plant growth (with demonstrations with the microscope) will be discussed, with frequent experiments and field excursions. The entire country within the reach of the University is a great natural laboratory, full of interest and information for all. The course explains these features which become so familiar to everyone residing here.

CHEMISTRY

A year's work with the text and in the laboratory, in such proportions as the instructor decides upon. Each student must keep a notebook in which he describes the process and results of his laboratory work.

PHYSICS

The course aims to show that physics is not something abstract or mysterious, but is the simple explanation of everyday occurrences not usually understood and often unnoticed. It consists of three recitation periods and four laboratory periods per week, carried on along the lines laid down for the senior year in secondary schools. Each student must keep a notebook in which a minimum number of experiments must be written up.

HISTORY

The aim of the work in history is to lead the pupil to see the development of races and nations along political, social, and religious lines, and to arouse in him a love for the subject and a habit of broad and discriminating reading.

The work of the first year consists of a survey of the development of the characteristics of the Greek and Roman civilizations. A text such as Wolfson, *Essentials of Ancient History*, or West, *Ancient History*, will be supplemented by collateral reading and a notebook.

The work of the second year includes mediaeval and modern history. The aim is to give the student an idea of the essential unity of history and the leading facts in the political development of races and

nations. Harding, *Essentials of Mediaeval and Modern History*, is used, supplemented by the reading of references.

Hart, *Actual Government*, or Foreman's *Advanced Civics*, is the textbook in civics. The historical development of the subject is made prominent, while practical problems, such as taxation and municipal government, are made the subjects of special investigation and study. The text in history will be James and Sanford, *American History*, or Channing, *Students' History of the United States*.

LATIN, GREEK, FRENCH, GERMAN, AND SPANISH

One of these languages must be begun in the first or second or third year, and be pursued for at least two years.

For an outline of the courses in Latin and Greek see page 38, under requirements for admission.

For an outline of the courses in French, Spanish and German, see pages 80, 83, and 101.

BOOKKEEPING AND COMMERCIAL PRACTICE

Bookkeeping is taught by the modern budget system. The work is individual and each student may progress as fast as his time and ability permit. The course is thorough in all the details of office practice. Students are made familiar with different filing cabinets, the filing of letters, the use of card ledgers, and indexing. All students in bookkeeping are required to take some other branch of mathematics and must show proficiency in English.

STENOGRAPHY AND TYPEWRITING

A complete course in stenography is offered. The object of the course is to train students so that they may become practical stenographers. With this end in view particular stress is laid upon neatness, filing, copying and indexing. This branch of the commercial department is equipped with up-to-date filing cases, and seven standard make typewriters of latest models. *Students taking this work are required to have had one year of High School English, and to take English with this course.*

AGRICULTURE

The following courses in Agriculture may be elected by prepara-

tory students: Agr. 1 (Plant Culture), Agr. 2 (Farm Crops), Agr. 3 (Live Stock Judging), Agr. 4 (Elements of Dairying), Agr. 14 (History of Breeds), Agr. 15 (Poultry).

Any two of the above half-year courses will count one credit in the preparatory course. For description of the courses, see pages 55 to 61.

DEBATING

The Drachman Prize Debate is open to all students of the University. Before the preliminary debates, the contestants receive practice and training in debate in the various classes in economics and in the literary society for the young women, known as "The Wranglers," and the young men's debating club, called the "Philomatheon." From those who enter the preliminaries, the six best debaters are selected as contestants for the final debate, which takes place about prize, debates on public questions are held regularly in the classes in economics throughout the year and several public debates are given by the two societies.

To encourage interest and efficiency in debating in the University Mr. Harry A. Drachman, of Tucson, offered in the last academic year a prize of \$40. This was divided between the best and second best debaters, \$25 to the first and \$15 to the second. The prize is to be continued for the year 1911-12.

The winners of the Drachman Prize for 1910-11 were: Walter Clay Lowdermilk, *First Prize*; Horace Merle Cochran, *Second Prize*.

PUBLIC LECTURES AND ADDRESSES TO STUDENTS
JANUARY TO JUNE, 1911

1911

January 6.

Eugene W. Chafin, on United States History.

February 8.

William Jennings Bryan, on Public Speaking.

March 23 and 24.

Debates with Tucson High School.

March 31.

Meeting of High School Principals.

April 18.

Drachman Prize Debate.

May 11.

Courtenay DeKalb, on Standard of Living and Civilization.

May 28.

Baccalaureate Address, Bishop Julius W. Atwood.

May 30.

Patriotic Service of the University and of the Townspeople.

Addresses by Hon. John B. Wright, General Thomas Wilson and ex-Governor L. C. Hughes.

June 1.

Commencement Address, Professor Andrew Ellicott Douglass,
Ph. D.

MILITARY ORGANIZATION

April 18, 1911

CAPTAIN HIRAM M. POWELL, U. S. A., Commandant of Cadets

STAFF

Adjutant 1st Lieutenant.....	L. D. LaTourrette
Sergeant Major.....	Frank L. Culin

COMPANY A

Captain.....	Clifton H. Rolfe
1st Lieutenant.....	W. R. Campbell
2nd Lieutenant.....	W. Harold Munds
1st Sergeant.....	Ernest L. Barnes
Sergeant.....	J. Stuart Bogan
Sergeant.....	Herbert N. Bradstreet
Corporal.....	Francis Mack
Corporal.....	Joseph F. Burns
Corporal.....	L. W. Lowdermilk

COMPANY B

Captain.....	Arthur C. Lovejoy
2nd Lieutenant.....	Frank M. Cannon
1st Sergeant.....	Richard L. Merritt
Sergeant.....	Roy W. Irvine
Sergeant.....	S. B. Whitwell
Corporal.....	Clyde W. Ijams
Corporal.....	Lowell W. Overlock
Corporal.....	Chas. Isbell

COLOR SERGEANTS

Sergeant.....	Ralph Rigg
Sergeant.....	Fred W. Rogers

TRUMPETERS

Sergeant.....	Marcus A. S. Ming
Corporal.....	Chas. F. Simonds
Private.....	Lawrence S. Hedges
Private.....	Daniel Olney

ALUMNI REGISTER

The Alumni Association of the University of Arizona, organized on the second day of June, 1897, represents the body of graduates of the University; its object, as expressed in its constitution, is "To promote the interests of the University, to secure unity among its graduates and to foster an attachment to our Alma Mater."

1895

Charles Oma Rouse, B. S. Died 1906.

Mercedes Anna Shibell, B. S., (Mrs. A. J. Gould), Tucson.

Mary Flint Walker, B. S., (Mrs. Pearl Adams), Benson.

1897

Edward Marshall Boggs, C. E., (nunc pro tunc), Chief Engineer Oakland Electric Railways, Oakland, California.

Clara Cramond Fish, B. S., (Mrs. F. C. Roberts), Tucson.

George Ojeda Hilzinger, B. S., Attorney, Tucson.

Mark Walker, B. S., Metallurgist, Los Angeles, California.

1898

Hattie Ferrin, B. S., (Mrs. Charles Solomon), Safford.

Granville Malcolm Gillett, B. S., Draughtsman in Surveyor General's Office, Phoenix.

Minnie Watts, B. S., (Mrs. W. B. Smith), Altaville, California.

John Desha Young, B. S. Died 1899.

1899

Robert L. Morton, B. S., Assayer, Yuma.

1900

Ida Clarissa Flood, B. S., (Mrs. G. Dodge), Oakland, California.

Samuel Pressly McCrea, B. S., A. B., Principal of High School, Redwood City, California.

Charles Pierce Richmond, B. S., Mining Engineer, Phoenix.

Florence Russell Welles, B. S., (Mrs. Wm. Angus), Los Angeles, California.

1901

Rudolph Castaneda, B. S., Engineer, Nacozari, Sonora, Mexico.

Clara Ferrin, B. S., Teacher, Tucson.

George Millard Parker, B. S., Denver, Colorado.

David Hull Holmes, B. S. (*nunc pro tunc*), Architect, Tucson.

1902

Andrew Gilbert Aiken, A. B., B. S., Surveyor, Canton, New York.

Moses Blumenkranz, B. S., Mining Engineer, El Paso, Texas.

Ruth Brown, Ph. B., (Mrs. Wilkins Manning). Died 1910.

Felix Grundy Haynes, B. S., Casa Grande.

Rose Belle Parrott, Ph. B., Teacher, Roseburg, Oregon.

Phillip Matthem Reilly, B. S.

Bertram L. Smith, B. S., Engineer, Phoenix.

Bessie Smith, Ph. B., (Mrs. Earle Davis), Douglas.

Walter James Wakefield, B. S., Manager Tucson Warehouse and Transfer Co., Tucson.

1903

Advanced Degrees:

LL. D., Hon. William Herring, Tucson.

M. A., John William Gorby, (B. A., Marietta), Chicago, Illinois.

M. A., Benjamin Franklin Stacey, (B. A., B. D., Lombard), Teacher, Pasadena, California.

Richard Lamar Drane, B. S., Assistant to Chief Engineer Randolph Lines, Tucson.

George Mark Evans, (LL. B., Michigan), Ph. B., Teacher, Los Angeles, California.

Leslie Alexander Gillett, B. S. (Mining), U. S. Mine Inspector, Santa Fé, New Mexico.

Georgia Ann Holmesley, Ph. B., Teacher, Clifton.

Edward Horton Jones, B. S., Assayer, Denver, Colorado.

John Willard Prout, Jr., B. S., General Manager Santa Cruz M. and S. Co., Mowry.

Thomas Edward Steele, B. S., Assayer, Sasco.

1904

William Burnham Alexander, B. S., Civil Engineer, Tucson.
Elbert John Hollingshead (Kimble), B. S., Clerk, Seattle, Washington.

Estella Markham Prout, Ph. B., Teacher, Mowry.

John Willard Prout, Jr., B. S. (Mining), see 1903.

1905

Ora Elinor Norway, Ph. B. Died 1908.

1906

Advanced Degree:

M. S., William B. Begg, (A. B., Toronto), Philippine Islands.

Chester Bennett Clegg, B. S. (Civil Engineering), Phoenix.

John Wesley Gebb, B. S., Engineer, 1401 Santee St., Los Angeles.

Roy Bartley Kilgore, B. S. (Mining), Seattle, Washington.

Roy Gibbons Mead, B. S., Mineral Inspector, U. S. General Land Office, San Francisco.

Roy Webb Moore, B. S. (Mining), Mining Engineer, Tucson.

Carobel Murphey, (A. B., Cox College), Ph. B., Teacher, Tucson.

Ida Christina Reid, Ph. B., Instructor, University of Arizona, Tucson.

Minnie Louise Wooddell, Ph. B., Teacher, Tucson.

1907

Advanced Degree:

Engineer of Mines, John Willard Prout, B. S., (Mining). See 1903.

Charles Alexander, Ph. B., Teacher, Tempe.

Harriet Estella Brown, Ph. B., Teacher, Tucson.

Lawrence Brodhead Croasdale, B. S. (Mechanical Engineering), Draughtsman, Delaware Water Gap, Pa.

Weda Ina Purcell, Ph. B., (Mrs. Ivy Marshall), San Francisco, California.

Hugh Maupin Wolfkin, B. S., in charge of Mine Rescue Car, Seattle, Washington.

1908

Honorary Degree:

LL. D., William Phipps Blake, Sc. D., Tucson.

Carroll Pitkin Bradstreet, B. S., Pachuca, Mexico.

Benjamin Scott Dinsmore, B. S., Miami, Arizona.

William Arthur Tarr, B. S. (Mech. Eng.), Oklahoma, (Agricultural); B. S. (Mining), Fellow and Assistant in Geology, University of Chicago, Chicago, Illinois.

Hugh Maupin Wolfkin, B. S. (Mining). See 1907.

Leigh Ernest Worthing, B. S., Bay City, Michigan.

1909

Burrell R. Hatcher, B. S. (Mining), Mining Engineer, Oracle.

Ethel A. Hooper, Ph. B., Tucson.

Grace Ysabel LaBaree, Ph. B. Died 1910.

Anita Calneh Post, Ph. B., Teacher, Yuma.

John Mosheim Ruthrauff, B. S. (Metallurgy), Tucson.

Arthur Perry Thompson, B. S. (Mining), Garfield, Utah.

Mabel Wilkerson, Ph. B., Recorder's Office, Tucson.

1910

Ernest Orrin Blades, B. S. (Mining), Draftsman, 308 13th St., Portland, Oregon.

Lawrence Arthur Callaway, B. S. (Mining), Marshfield, Missouri.

Miles Miller Carpenter, B. S., Tucson.

Fletcher Morril Doan, Jr., B. S. (Mining), Baluda, Sonora, Mex.

Ida Whittington Douglass, Ph. B., Tucson.

Warren Arthur Grossetta, B. S. (Mechanical Engineering).

Joseph Clyde Hoyt, B. S. (Mining), Assistant Mining Engineer, Jerome.

Leslie Creighton Millar, B. S., Minneapolis, Minnesota.

Willard Henry Nash, B. S., 406 W. Ferry St., Buffalo, New York.

R. Izer Turner, Ph. B., 543 W. Chestnut St., Anaheim, California.

REGISTER OF STUDENTS

GRADUATES

Carpenter, Miles Miller (B. S. Arizona)	Tucson
Millar, Leslie Creighton (B. S. Arizona)	Tucson
Roberts, Elizabeth Ellinwood (A. B. Western Reserve)	Tucson

SENIORS

Bogan, Phebe M.	Tucson
Harrison, Ralph Waldo	Ashland, Wisconsin
Hartmann, Miner Louis	Phoenix
Higgins, John Joseph	Los Angeles, California
Kitt, Katherine	Tucson
Purcell, Ivy Mae	Tucson
Rebstock, Duane	Phoenix
Rider, Jane Herbst	Tucson
Rose, Frank Winfred	Solomonville
Sine, Janet Volume	Tucson
Strong, Leon Henri	Tucson

JUNIORS

Bone, James Lee	Phoenix
Bryan, William Jennings, Jr.	Tucson
Elliott, Loyd Creighton	Phoenix
Flanagan, James Joseph	Los Angeles, Cal.
Geringer, Otto George	Chicago, Ill.
Groweg, Edward A.	Tucson
Lusk, Harry Wilton	Tucson
McDole, Maynard Matthew	Tucson
McNeil, Clara Mae	Tucson
Nishihara, George Shikataro	Tucson
Rodee, Nona M.	Tucson

SOPHOMORES

Barnes, Ernest Lee	Humboldt
Brown, Marguerite Bernice	Tucson
Bradstreet, Herbert Neal	Bisbee
Campbell, Otis Muscott	San Bernardino, Cal.
Cook, John Carl	Douglas
Cochran, Horace Merle	Crawfordsville, Ind.
DeLuce, Dona Dea	Dome
Firth, Charles Abraham	Aravaipa
Estill, Howard Wilmot	Tucson

Geringer, John Charles	Chicago, Ill.
Irvine, Elroy Sidney Jackson	Phoenix
La Tourrette, Lyman Dalton	Phoenix
Lindley, James Cary	Tucson
Lovejoy, Arthur Leacock	Tucson
Lowdermilk, Walter C.	Willcox
McClure, John Englebright	Tucson
Merritt, Richard Lewis	Prescott
Munds, William Harold	Prescott
Purcell, Marie Ella	Tucson
Russell, Rolla Wayne	Magdalena, N. M.
Schoonmaker, Hazel I.	Tucson
Spaulding, George Frederick	Phoenix
Wetenkamp, Paul	Warren
Whitwell, Sturgis Bigelow	Tucson
Wilky, Leslie Guy	Phoenix

FRESHMEN

Aylworth, Herbert Rolland	Prescott
Burns, Joseph Frederick	Anaheim, Cal.
Brown, Mae	Globe
Caballero, Augusto Davis	Tucson
Cannon, Frank Mullin	Congress
Chittenden, Ross Armour	Tucson
Cole, Margaret Ruth	Globe
Corda, Mamie Wilhelmina	Tucson
Cozart, John Guy	Lamar, Ark.
Cromb, Christina Rankin	Clifton
Culin, Frank Lewis, Jr.	Helvetica
Eichoff, William	S. Pasadena, Cal.
Hatcher, William Ernest	Douglas
Hunt, Samuel L.	Bisbee
Ijams, Clyde W.	Safford
James, Herbert Hanna	Pittsburg, Pa.
La Tourrette, Verne Gerald	Phoenix
MacPearson, Maud	Nogales
Mashbir, Sidney Freudenthal	Safford
Micotti, Alfred Dominguez	Tucson
Moore, Mabel Martha	Yuma
Pistor, Karl William	Tucson
Powers, James Knox, Jr.	Ft. Huachuca
Rodolf, Fred W.	Tucson
Rogers, Frederick William	Tucson

Salazar, Jose Urbano	Chihuahua, Mex.
Schoshusen, John Helmut	Tucson
Spaulding, Florence Kirkland	Yuma
Spaulding, Jay Harvey	Yuma
Swan, Laura Mae	Tucson
Theroux, Henry George	Swansea
Thrift, Inez Esther	Phoenix
Whittington, Frank Southey	Los Angeles, Cal.
Wooddell, Grace Helen	Tucson

UNCLASSIFIED COLLEGE

Blake, Gertrude	Casa Grande
Bogert, Jessie	Tucson
Cameron, Jean Hunter	Tucson
Dickison, Cecil Norman	Tucson
Franco, Salvador Serna	Tucson
Gilbert, Charles C.	Tucson
Goodrich, Catherine W.	Tucson
Guild, Marilla M.	Tucson
Herald, Roy Cameron	Tucson
Highfill, Ernest Raymond	Tucson
Lawson, Alice P.	Tucson
MacDougal, Louise Fisher	Tucson
Marshall, Thomas K.	Tucson
Moore, Folsom	Tucson
Murphey, Elizabeth B.	Tucson
Ochoa, Elseo Beinto	Tucson
O'Connell, Mildred Linza	Tucson
Rodolf, Alvena Pearle	Tucson
Roletti, Charles John	Tucson
Sanborn, Mabel	Tucson
Talcott, William Ariel	Tucson
Upham, Caius John	Tucson
Vail, Thirza	Tucson
Walker, Norma Pauline	Macon, Mo.

SHORT COURSE IN AGRICULTURE

Gibbs, Frank	Tucson
Parker, Sumner William	Anderson, Ind.
Schwab, Daniel	Moscow, Russia
Stewart, Justin Henry	Tucson

FOURTH PREPARATORY

Bird, Walter Duane	Nogales
Bogan, John Stuart	Tucson
Campbell, William Riggs	Tucson
Cameron, Alice Faith	Tucson
Colton, Fannie Alberta	Tucson
Gaddis, Homer Baker	Kingman
Hofmeister, Irene	Tucson
Lindsley, Richard G.	Tucson
MacDougal, Alice	Tucson
Mack, Francis Cagwin	Tucson
Overlock, Lowell W.	Tucson
Pusch, Maybelle	Tucson
Rolfe, Clifton Howard	Swansea
Scheerer, Cedric Ezra	Twin Buttes
Storrs, Marguerite Chloe	Red Rock
Underhill, Howard Lawrence Talcott.....	Tucson

THIRD PREPARATORY

Bennie, John Willis	Clifton
Brichta, Louis C.	Tucson
Catron, Gertrude Leona	Cananea, Mexico
Cloud, Leo Frederick	Tucson
Glennon, Joseph Henry.....	Nacozari, Sonora, Mexico
Isbell, Charles Woodruff	Tucson
Kendall, Marcus Todhunter	Ocean Park, California
Lee, George Murat	Anderson, Indiana
Ming, Marcus Aurelius Smith.....	San Carlos
Patton, Marion Lee	Bisbee
Pendleton, Ernest Conway	Berkeley, California
Rea, Helen	Tucson
Simonds, Charles Friend	Tucson
Wakefield, Edith	Tucson
Wheeler, Buckley Adams	_____

SECOND PREPARATORY

Cassiday, Florence Mabel	Tucson
Ellenburg, Frank	Tucson
Glenn, John Brooks	Lynchburg, Virginia
Hedges, Lawrence Seitz	Chattanooga, Tennessee
Larsson, Axel	Tucson
Munds, Sadie Grace	Prescott
Nix, Margaret Patterson	El Tigre Mines, Mexico

Renaud, Ernest James	Pearce
Spaulding, Charles Raymond	Safford
Stewart, Jeb	Florence
Sykes, Eugene Knight	Calabasas
Thompson, Ellen	Globe
Wilkerson, Edith	Ventura, California

FIRST PREPARATORY

Blake, John Walter	Phoenix
Blake, Mable Annetta	Phoenix
Brewer, Richard	Empalme, Mexico
Clark, Frank Moorman	Solomonville
Day, Nina Sybil	Pasadena, California
Hooks, William Clint	Safford
Jennings, Arthur Curtis	Safford
Maldanado, Ramon, Jr.	Magdalena, Mexico
Olcott, Arthur Wellesley	Tucson
Olney, Dan Clinton	Safford
Samuel, Lemuell William	Solomonville
Schroeder, Carl Ernest	Safford
Williams, Moore George	Mineral Wells, Texas

UNCLASSIFIED PREPARATORY

Bird, Allen Tracy, Jr.	Nogales
Casanega, Florence Pauline	Calabasas
Christenson, Elmer William	Silverbell
Chafin, Desdemona Eleanor	Tucson
Cole, Carl Henry	Globe
Cole, Orlando C.	Tucson
Davis, Minnie Carmen	Tucson
Evans, Gladys Lovette	Tucson
Hinkely, Katherine Hall	Tucson
Langers, Meta	Tucson
Lummis, Turbese Dorothea	Tucson
Lutgerding, Robert Linville	Phoenix
Nichols, Louise Wichman	Tucson
Ostermann, Jose	Hermosillo, Mexico
Powers, Helen	Tucson
Skidmore, Edgar Hamilton	Tucson
Soto, Ernest Steve	Courtland
Smith, Evelyn Terana	Tucson
Thompson, Louise	Globe
Udall, Gladys Madge	Tucson

Young, Louis Ellison	Tucson
Zander, Ramona Irene	Tucson

SHORT COURSE IN AGRICULTURE

Quine, Alfred J.	Tucson
Rowell, Robert Strong	Tucson
Tierce, Homer Fleming	Cananea, Mexico
Williams, Isaac J.	Congress

SUMMARY**COLLEGE STUDENTS**

Graduate Students	3
Seniors	11
Juniors	11
Sophomores	25
Freshmen	34
Short Course in Agriculture	4
Unclassified	24—112

PREPARATORY STUDENTS

Fourth Years	16
Third Years	15
Second Years	13
First Years	13
Short Course in Agriculture	4
Unclassified	22— 83

Total for the University	195
--------------------------------	-----

ADDENDA AND CORRECTIONS

METALLURGY

The statement on page 45 of the catalogue is superseded by the fuller announcement in Course VI on page 50.

DORMITORIES

At the meeting of the Regents of the University, June 10, 1911, it was voted that an annual dormitory fee of \$25 be charged each student. This fee will include the former charge for lighting, and the balance will be applied to the maintenance and repairs of the dormitories.

The dormitory fee will be payable as follows: \$10 at the opening of the year, \$5 at the beginning of each of the second, third, and fourth quarters. No refund will be made in case of withdrawal before the end of any quarter.

INDEX

- Admission, 35-40.
Advanced Standing, 39.
Agriculture, 21, 43, 55, 103, 119.
Agricultural Experiment Station, 105.
Alumni Register, 123.
Astronomy, 28, 61.
Assaying, Fees, 107, 108.
Bachelor of Arts, Degree, 42.
Bachelor of Science, Degree, 43; B. S. in Agriculture, 43-45; in Civil Engineering, 46; in Metallurgy, 50; in Electrical Engineering, 47; in Mechanical Engineering, 49; in Mining Engineering, 52.
Biology, 23.
Board, 32.
Bookkeeping, 119.
Buildings, 13.
Botany, Admission, 39.
Botany, College, 62.
Bureau of Mines and Assaying, 107.
Calendar, 2.
Certificates of Admission, 40.
Chemistry, 23.
Chemistry, Admission, 39.
Chemistry, College, 64.
Civil Engineering, 24, 46, 66.
Climate, 12.
Committees, 9.
Debating, 120.
Degrees, Advanced, 53.
Degrees, Courses of Study for, 41.
Discipline, 32.
Dormitories, 32, 133.
Economics, 71.
Electrical Engineering, 26, 47, 74.
Electives, Admission, 39.
Endowment, 16.
English, Admission, 36.
English, College, 77.
Expenses, 33.
Faculty, 3.
Fees, 33.
Fees for Assaying, 108.
Fees for Ore Testing, 109.
French, Admission, 38.
- French, College, 80.
Geology, 81.
German, Admission, 38.
German, College, 83.
Greek, Admission, 38.
Greek, College, 85.
Gymnasium, 15, 29.
History, Admission, 37, 118.
History, College, 85.
Holidays, 32.
Laboratory Fees, 34.
Latin, Admission, 38.
Latin, College, 87.
Library, 16.
Library Building, 13.
Loan Funds, 34.
Location, 12.
Maintenance, 15.
Mathematics, Admission, 37.
Mathematics, College, 87.
Mechanic Arts, 25, 89.
Mechanical Engineering, 26, 49, 90.
Metallurgy, 14, 27, 50, 92, 133.
Military, 30, 122.
Mill, 14.
Mineralogy, 28, 94.
Mine Surveying, 52.
Mines, School of, 31.
Mining Engineering, 52, 95.
Museum, 13, 20.
Normal Schools, Admission from, 40.
North Hall, 14.
Ore Testing, Fees, 109.
Organization, 10.
Petrography, 28.
Philosophy, 97.
Physical Geography, 39, 117.
Physical Training, 98.
Physics, 28.
Physics, Admission, 39, 118.
Physics, College, 100.
Preparatory Department, 111.
Course of Study, 113.
Public Lectures, 1911, 121.
Records, 31.
Regents, 3.

Register of Students, 127.
Registration, 31.
Science Hall, 13.
Short Course in Agriculture, 103.
South Hall, 14.
Spanish, Admission, 38.
Spanish, College, 101.

Stenography, 119.
Students, Register of, 127.
Typewriting, 119.
University Hall, 13.
Vacations, 32.
Women's Dormitories, 14.
Zoology, 102.

If you are interested in the University of Arizona, please mail this page, filled out, to the President. Cut along the line at the left of the page.

Name

Address

I am interested in the courses of study checked below:

- A General College Course.
- A General Scientific Course.
- An Agricultural Course.
- Civil Engineering.
- Electrical Engineering.
- Mechanical Engineering.
- Mining Engineering.
- Metallurgy.
- A Preparatory Course.

Please send your Register to the persons named below:

NAME

ADDRESS

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

THE NEEDS OF THE UNIVERSITY—AN IDEAL EQUIPMENT

THE GREATEST NEED

That the People of the Territory have a fuller apprehension of the work being done by the University.

LESSER NEEDS

A New Dormitory for Young Women.

An Auditorium Building, housing also the Museum.

A Mining Building.

A Mechanic Arts and Metallurgy Building.

A Building for the School of Agriculture and for the Agricultural Experiment Station.

A Club House or “Union” for Students, especially for the men, to provide more adequately for the social life of the campus.

THE University of Arizona Record is issued five times a year, usually in January, March, May, September and November.

Entered as Second-Class Matter at the Postoffice at Tucson, Arizona, under the Act of July 16, 1894.

The Record includes the following publications: The Annual Report of the President of the University to the Board of Regents. The Annual Register of the University. The Announcements of the School of Mines, the Geological Survey, and the several Departments of Instruction and Research.

78.791
UH1

University of Arizona Record

VOLUME V, NUMBER 3

MARCH, 1912

REGISTER 1911-12

WITH ANNOUNCEMENTS FOR 1912-13

PUBLISHED BY THE
UNIVERSITY OF ARIZONA
TUCSON, ARIZONA

THE UNIVERSITY OF ARIZONA

TUCSON, ARIZONA

DEPARTMENTS OF UNIVERSITY WORK

The General College Course leading to the Degree of Bachelor
of Arts or Bachelor of Science

Agriculture—the Four-Year Course and the Short Course

Civil Engineering

Electrical Engineering

Mechanical Engineering

Mining Engineering

Metallurgy

The Mechanic Arts

The Agricultural Experiment Station

The Preparatory Department

All of these departments of work are situated at Tucson, insuring
the unity of the University, breadth, efficiency, and economy of
instruction and administration.

Address all correspondence to

ARTHUR H. WILDE, President,
The University of Arizona,
Tucson, Arizona.

University of Arizona

REGISTER

1911-12

WITH ANNOUNCEMENTS FOR
1912-13

TUCSON, ARIZONA
1912

H.C.P.

CALENDAR

1912

Sept. 23 and 24, Mon. and Tue.	Registration Days
Sept. 25, Wed.	First semester begins
Oct. 5, Sat.	Condition examinations
Nov. 28, Thu.	Thanksgiving Classes will have their regular sessions, Fri. and Sat., Nov. 29 and 30
Dec. 20, Fri., 4 p. m.	Holiday recess begins

1913

Jan. 2, Thu.	Instruction resumed
Jan. 4, Sat.	Condition examinations
Jan. 22, 23, 24, 25	First semester examinations
Jan. 27, Mon.	Second semester begins
Feb. 22, Sat.	Holiday
May 30, Fri.	Holiday
June 1, Sun.	Baccalaureate discourse

OFFICERS OF ADMINISTRATION, INSTRUCTION AND INVESTIGATION

BOARD OF REGENTS

EX-OFFICIO

HIS EXCELLENCY, GEORGE W. P. HUNT.....Phoenix
Governor of Arizona

HON. CHARLES O. CASE.....Phoenix
Superintendent of Public Instruction

APPOINTED

MERRILL P. FREEMAN, LL. D.....Tucson
Chancellor and President

CHARLES H. BAYLESS, A. M., Treasurer.....Tucson

JOHN C. GREENWAY, PH. B.....Warren

WILLIAM J. MURPHY.....Phoenix

FACULTY

ARTHUR HERBERT WILDE, Ph. D., President.
President's House, University Campus
Professor of History. 1911

ROBERT HUMPHREY FORBES, M. S. 105 Olive Road
Director and Chemist, Agricultural Experiment Station. 1894

FRANK NELSON GUILD, M. S. 107 Olive Road
Professor of Chemistry and Mineralogy. 1897

*Dates following titles indicate appointment to service in the University.

GEORGE EDSON PHILIP SMITH, C. E.	1195 Speedway
Irrigation Engineer, Agricultural Experiment Station.	1907
*JOHN JAMES THORNBERRY, A. M.	Olive Road
Professor of Biology; Botanist, Experiment Station.	1901
CYRUS FISHER TOLMAN, Jr., B. S.	Park Ave. and Rincon Rd.
Professor of Geology and Mining Engineering.	1905.
WILLIAM WHEELER HENLEY, A. B.	First St., near Vine St.
Professor of Mechanical Engineering and Mechanic Arts.	1905
ANDREW ELICOTT DOUGLASS, Sc. D.	Olive Road and Speedway
Professor of Physics and Astronomy.	1906
ALBERT EARLE VINSON, Ph. D.	914 N. Fourth Ave.
Biochemist, Agricultural Experiment Station.	1905
*CHARLES ALFRED TURRELL, A. M.	835 Tyndall Ave.
Professor of Modern Languages.	1904
LESLIE ABRAM WATERBURY, C. E.	327 E. Fourth St.
Professor of Civil Engineering.	1907
ROBERT RHEA GOODRICH, M. S.	645 E. Third St.
Professor of Metallurgy.	1907
ROBERT WAITMAN CLOTHIER, M. S.	639 N. Park Ave.
Professor of Agriculture; Conductor of Farmers' Institutes.	
1907	
ERNEST SUTHERLAND BATES, Ph. D.	908 Speedway
Professor of English.	1908.
HENRY ALFRED ERNEST CHANDLER, B. S.	North Hall
Professor of Economics and History.	1908
NATHAN CESNA GRIMES, A. M.	113 Olive Road
Professor of Mathematics.	1910

*Absent on leave.

- HIRAM McL. POWELL. 876 E. Third St.
Professor of Military Science and Tactics. 1909
- GEORGE FOUCHE FREEMAN, B. S. 817 E. Fifth St.
Plant Breeder, Agricultural Experiment Station. 1909
- AUSTIN WINFIELD MORRILL, Ph. D. 235 W. Monroe St., Phoenix
Entomologist, Agricultural Experiment Station. 1909
- FREDERICK W. WILSON, B. S. Experiment Station Farm, Phoenix
Animal Husbandman, Agricultural Experiment Station. 1905
- WILLIAM LUCIUS FOWLER, B. S. South Hall, University Campus
Assistant Professor of Animal Husbandry. 1909
- WILLIAM GEORGE MEDCRAFT, A. M. 726 E. Fifth St.
Assistant Professor of Mathematics. 1905
- BEDROS TATARIAN, B. S. 933 N. Euclid Ave.
Assistant Professor of Chemistry. 1911
- FRANCES MELVILLE PERRY, A. M. 1207 Speedway
Assistant Professor of English. 1910
- WILLIAM HORACE ROSS, Ph. D. 833 E. Fourth St.
Assistant Chemist, Agricultural Experiment Station. 1907
- FRANK CALEB KELTON, B. S. 412 E. Fourth St.
Assistant Engineer, Agricultural Experiment Station. 1909
- LEVONA PAYNE NEWSOM, Ph. D. Fourth St. and Euclid Ave.
Assistant Professor of Latin and Greek. 1905
- MARION CUMMINGS STANLEY, B. L. Center St. near Speedway
Assistant Professor of Philosophy. 1902
- ALEXANDER McOMIE, B. S. 826 E. Fourth St.
Assistant Agriculturist, Agricultural Experiment Station. 1910
- WILLIAM LUCIUS FOWLER, B. S. South Hall, University Campus
Assistant Professor of Animal Husbandry. 1909

- ESTELLE LUTRELL, A. B.** 731 No. First Ave.
Instructor in English, Librarian. 1904
- FREDERICK EDWIN TALMAGE, B. L.** Olive Road
Instructor in Stenography and Bookkeeping; Secretary of the University. 1904
- IDA CHRISTINA REID, Ph. B.** 149 E. Pennington St.
Instructor in History and Mathematics. 1906
- FRANK LEWIS KLEEBERGER, B. S.** Tucson
Instructor in Chemistry and Physical Training; Director of the Gymnasium. 1908.
- JAMES GREENLEAF BROWN.** 23 East Ochoa St.
Instructor in Botany. 1909
- WILLIAM JAMES GALBRAITH, JR.** 725 E. Fourth St.
Instructor in Law. 1909
- BERT AUGUSTUS SNOW, B. S.** South Hall
Instructor in Electrical and Mechanical Engineering. 1910
- JOSEPHINE MACK, B. A.** 1207 Speedway
Instructor in English and Physical Training. 1910
- IDA WHITTINGTON DOUGLASS. Ph. B.** Olive Road
Instructor in Spanish, French, and Physical Geography. 1910
- ARTHUR HAMILTON OTIS, A. B.** 149 E. Pennington St.
Instructor in Modern Languages. 1911
- DONALD FORSHA JONES, B. S.** 803 E. Seventh St.
Assistant Plant Breeder in Experiment Station.
- ANGELA E. O'BYRNE.** 124 N. Stone Ave.
Instructor in Music. 1910.
- ELIZABETH ELLINWOOD ROBERTS, A. B.** 503 E. Second St.
Instructor in German. 1911

- MARY McFARLAND CANTWELL, M. A. 838 N. Euclid Ave.
Instructor in Evening Class in Spanish. 1911
- ARTHUR GARFIELD SCHNABEL, M. D. 21 E. Pennington St.
Instructor in Bacteriology. 1911
- E. DANA TROUT, 803 E. Seventh St.
Secretary of the Agricultural Experiment Station. 1909
- HERBERT BROWN, 220 N. Court St.
Curator of the State Museum
- MRS. IDA TALCOTT UNDERHILL. West Cottage, University Campus
Preceptress of Young Women. 1910
- JOHN ELVIN LOGAN. University Campus
Superintendent of Grounds. 1912
- MABEL AENELLA GUILD. Olive Road
Assistant Librarian
- HELEN CHURCH. President's House, Campus
Office Secretary. 1911
- MARIA THERESA SIMONDS. 845 E. Fourth St.
Bookkeeper. 1911

UNIVERSITY OF ARIZONA

Established by Act of Legislative Assembly, 1885; Open to Students,
October, 1891

PURPOSE AND ORGANIZATION

The University of Arizona is an integral part of the system of public education established by and for the Territory, and aims, as the head of such system, to fill the same position as that occupied by the state universities in such states as California and Wisconsin. Its general organization is in accordance with the Act of Congress of July 2, 1862, known as the Morrill Act, creating the "Land Grant Colleges." The details of its organization and government are regulated by the Act of the Legislative Assembly of the Territory of Arizona, passed in 1885, and embodied, with amendments, in the Revised Statutes of Arizona Territory, 1901, which vests the government of the institution in a corporation styled the Board of Regents of the University of Arizona, consisting of the Governor and Superintendent of Public Instruction of the Territory, ex-officio, and four other members appointed by the Governor for a term of four years.

In creating the University, the Legislative Assembly wisely followed the example of the great states of Wisconsin, Illinois, Minnesota, Nebraska, and California, in unifying under one management the various schools and institutions of higher learning or investigation in Arizona,—the colleges of liberal arts, the schools of mining and engineering, the agricultural college, and the agricultural experiment station, which in some states have been widely and completely separated. No professional schools of law, medicine, dentistry, or music have been established. In compliance with the provisions of the Act creating it, the University consists of

- I. The College of Agriculture and Mechanic Arts.
- II. The School of Mines.
- III. The Agricultural Experiment Station.
- IV. The Preparatory Department.

The Normal Department, authorized by the statute, has not yet been organized. The Preparatory Department, which is really a complete manual training high school with a four years course, will gradually disappear as the educational system of the Territory is developed by the establishment of efficient high schools, but no date is set for abolishing even the first year of this preparatory course.

The University in all departments is open to properly qualified persons of both sexes. Through the aid received from the United States and from the Territory, it is enabled to offer its privileges to residents and non-residents, with only very moderate charges. The number of students in any one class or section of a class is kept below twenty, in order that each student may receive the individual attention of the instructors and thus gain the full advantage derivable from a small school.

The purpose of the University of Arizona is, in the language of the organic law, "to provide the inhabitants of this Territory with the means of acquiring a thorough knowledge of the various branches of literature, science, and the arts," and so far as possible a technical education adapted to the development of the peculiar resources of Arizona. In furtherance of this latter purpose, instruction is provided especially in subjects fundamental to agriculture, the mechanic arts, mining and metallurgy. The University, by the nature of its situation, frankly lays special emphasis upon the course in mining engineering. It is, in reality, a great mining laboratory, surrounded as it is on all sides by great mines. Some of these mines developed on a large scale are within a few miles of the city, and the number and magnitude of such enterprises are steadily increasing. Probably no University in the United States offers such fine advantages to the students of mining engineering who desire to see the actual operation of great mines, or the development of great enterprises, while carrying on the theoretical and experimental work of the mining course.

The advantages in civil engineering are hardly less noteworthy, for Tucson is not only a division point on the main line of the Southern Pacific railroad, with large shops, roundhouses, and engineering offices, but it has the administrative and engineering headquarters for five of

the subsidiary or allied lines of the Southern Pacific system in Arizona and in Sonora, Mexico, commonly known as the Randolph lines, including the great West Coast Line which will reach from Guaymas to Mazatlan and Guadalajara, in Mexico. All of these lines are undergoing extensive expansion and re-building, and so furnish excellent opportunities for observation and vacation employment for students of civil engineering.

LOCATION AND CLIMATE

The University of Arizona is located at Tucson, a city of eighteen thousand inhabitants, on the main line of the Southern Pacific railway, 312 miles west of El Paso, Texas, and 500 miles east of Los Angeles, California. The city lies in a broad flat valley at an elevation of 2,400 feet above sea level and is surrounded by mountains. Its dry, mild, and equable climate has made Tucson a famous winter resort unsurpassed for healthfulness.

The winter climate is especially good; the temperature is cool and strengthening but not severe, the lowest temperature recorded during the average year being about twenty degrees above zero, Fahrenheit. Little rain falls during the winter; fogs are all but unknown; cloudy days are rare. The percentage of sunshine throughout the winter is greater than that recorded at any other place in the United States. Owing to the extreme dryness of the air the highest temperatures known are less oppressive to the senses and less dangerous to the health than the summer heats of the upper Mississippi Valley states. The total amount of rainfall averages less than twelve inches.

These advantages insure to students a comfortable education and a wide range of out-door sports and recreations throughout the college year.

The University Campus, consisting of fifty-five acres, is situated upon high ground about a mile from the business center of the city with which it is connected by an excellent electric street-car line. On every side it commands a view of mountain scenery of remarkable extent and grandeur. The buildings are lighted by electricity furnished by the city plant.

An abundant supply of unusually good water for household, labora-

tory, and irrigation purposes is drawn from a large well on the Campus from a depth of one hundred and twenty feet, thus securing immunity from the dangers of a contaminated water supply. The Campus has a complete sewer system connecting all the buildings, with one exception, with the city mains at the University gate.

The Campus, carefully laid out in drives, lawns, and gardens, with a large number of palms, olive, ash, umbrella, pepper, bagota, and cottonwood trees has the air of a well kept park.

BUILDINGS

The main building, University Hall, the oldest of the group, is 200 x 150 feet, two stories in height, the first of gray stone, the second of red brick. It is completely surrounded by a wide two-story veranda. The building contains recitation rooms, laboratories and apparatus rooms of various departments, an assembly room, and the office, laboratories and library of the Agricultural Experiment Station.

The Library and Museum building is a handsome structure of red brick and Bedford sandstone, with a massive tile roof. The interior finish is in natural oak and pine. The library reading room, on the second floor, is a large, well-lighted room, beautifully furnished with heavy solid oak reading tables, desks and wall cases. The stack room at the rear is fitted up with the most modern steel racks. The Museum occupies parts of the first floor and the west half of the second floor. Fine oak and plate glass cases constitute the furnishings. The offices of the president and secretary of the University, three lecture rooms for the departments of geology, mathematics, English and history, work rooms for the library and museum, and a laboratory for the department of geology are on the first floor.

Science Hall, a new building, of architecture harmonious with the Library, which it faces, was completed in April, 1909, at a cost of about \$40,000. Further appropriation was made in March, 1909, for furnishing and equipping the building, which was thus made ready for occupancy in September, 1909. The building, 145 x 60 feet, is of three stories, the first devoted to physics, the second to chemistry and mineralogy, and the third to botany and biology. The roomy attic and a superstructure on the roof are used as an astronomical observa-

tory. The forty rooms provided by this Science Hall give excellent accommodations in place of the crowded quarters endured by several departments in recent years in University Hall, and the removal of these departments to the new building gives the Agricultural Experiment Station much needed space for its expanding work.

North Hall, a dormitory, two stories in height, built of gray stone of fine quality, is occupied by the college men. Besides the parlor, and rooms of the instructor in charge, it contains seventeen rooms, each large enough to accommodate two students, besides bath and toilet rooms.

South Hall, a large brick building containing forty rooms, besides bath and toilet rooms and store rooms, is the dormitory mainly for preparatory students. It is heated by a hot water system. It will accommodate seventy-five students.

West Cottage, with its new four-room annex, is the dormitory for young women,—a two story brick house with wide porches, surrounded with vines, shrubbery, lawns and trees.

East Cottage furnishes additional accommodations for young women.

The Dining Hall, built of red brick, provides ample boarding accommodations for all persons living on the Campus.

The Shop and Assay building is a large, substantial brick structure. It contains a commodious drawing room for mechanical and free-hand drawing, a large laboratory for forge work, machine practice and carpentry, and a lecture room, instrument room, and material testing laboratory for the department of civil engineering. Two other rooms are used for lockers, and for the motor and engine. The assay laboratory and commercial assaying department occupy five rooms fully equipped with a large melting furnace, the necessary muffle furnaces, and other accessories for making complete and accurate assays.

The Mill or Mining Machinery building, located to the northeast of the main group of buildings, is a plain wooden structure in which are placed the stamp mills, jigs, concentrating tables, separators, etc., necessary for the mining laboratory.

Herring Hall, the gymnasium, is a very substantial high building, 40 x 80 feet, constructed of red brick and white plaster. It was erected in 1903, the gift of Professor James Douglas and his associates of the Copper Queen Consolidated Mining Company, through Colonel William Herring, after whom it was named, at the suggestion of Professor Douglas.

The pump house and mechanical engineering laboratory was built in 1905. By use of brick, cement and iron it is practically fire proof, thus insuring safety to the well and pumps supplying the University with water for all its uses.

A two-story brick residence is occupied by the President of the University.

Other buildings are the cottage occupied by the Superintendent of Buildings and Grounds, three greenhouses, a brick barn, and various smaller outbuildings used for shops and store rooms.

MAINTENANCE

The University is maintained by funds appropriated by the United States and by the Territory of Arizona. Fifty-seven sections of very valuable pine land in Coconino county have been set apart by the Federal government for the benefit of the University, but title and control of the land does not pass to the Board of Regents until the Territory is admitted as a State. In the meantime only a small sum is annually received from the leases of this land.

By the provisions of the Morrill Act of 1890, the University receives annually from the United States the sum of \$25,000 "to be applied only to instruction in agriculture, the mechanic arts, the English language and the various branches of mathematical, physical, natural and economic science, with special reference to their applications in the industries of life, and to the facilities for such instruction." This Morrill Fund is to be ultimately duplicated by the Nelson Fund, created by the Act of March 4, 1907, which appropriated \$5,000 for the year beginning July 1, 1907, and provided for an annual increase of \$5,000 until the total received by each state should be \$50,000 per year from the two funds. For the current year this fund reached its limit. The University receives from the same source, for the

support of the Agricultural Experiment Station, \$15,000 yearly from the Hatch Act of 1887; the Adams Act of 1906 for the current year yields \$15,000, giving the Station \$30,000 a year.

The appropriations of the Board of Control of the Territory for the year 1912 were \$38,470 for maintenance; \$12,500 for improvements; \$28,000 for a new dormitory; and \$8,700 for the work of the Agricultural Experiment Station.

In 1911 the El Paso & Southwestern System gave the University \$2,000 for the work of the Agricultural Experiment Station in carrying on experiments in dry farming in Cochise county.

The University also receives annually, from miscellaneous sources such as matriculation and tuition fees, rent of cottages, damage to University property, etc., about \$1,500. The receipts for board, light, etc., amount to about \$18,000 per year.

ENDOWMENT

By the munificence of Doctor James Douglas, of New York, the University received in June, 1908, "the sum of \$10,000 * * * the annual interest or income from which is to be annually applied, devoted, expended and used by said Board of Regents, or its successors in trust, for the purchase of instruments of precision and research, or special apparatus, for scientific instruction and education in the department of mineralogy and School of Mines of the University of Arizona, * * * but no part of said fund or income is to be used or applied to the purchase of mining or metallurgical machinery or supplies for such department or for the use of students in the chemical or metallurgical laboratories." The fund thus created has been named by the Board the Douglas Endowment Fund.

The Philo Sherman Bennett Scholarship is endowed by the gift of \$500 to the University in 1905, through the agency of Mrs. William Jennings Bryan, the income to be used in aiding young women to secure an education.

LIBRARY

The library contains 18,000 bound volumes and several thousand unbound bulletins and reports, chiefly agricultural. The accessions

for the scholastic year 1911-12 total 1500 volumes, exclusive of government documents. Since, of these accessions nearly one-half has been made within the last five years the books, as a whole, have a direct bearing upon the college work now offered. Of these volumes a collection of complete sets of scientific and literary periodicals, to which additions are made yearly, is of special service in reference work. The library was made a regular depository of United States Government documents in 1907. These publications have been placed in a separate room where they are arranged by departments. The library has this year added to its catalogue the U. S. card index to Experiment Station Literature. Since much of the early material therein indexed has been received through private donations and the later numbers secured by application to the various Experiment Stations our sets are now in satisfactory condition for use in reference work.

The books are classed by the decimal system and shelved in numerical order with a further author division according to the Cutter numbers. The catalogue is the usual dictionary card catalogue of authors, subjects and titles in one alphabetical arrangement. Printed cards from the Library of Congress are used, supplemented by typewritten cards for books reported as not in their stock.

The Reading Room is supplied with about 600 books of general reference which may be consulted by the students without any formality. All books with the exception of periodicals and books reserved for reference may be drawn for home use. The following is a partial list of serials and newspapers on file for the use of students.

LIST OF SERIALS

- | | |
|---------------------------------|--------------------------------|
| *Advocate of Peace, | *American Economist, |
| American Architect and Building | American Electro-Chemical So- |
| News, | cietry, Transactions, |
| American Association for the | American Forestry, |
| Advancement of Science, Pro- | American Geographical Society, |
| ceedings, | Bulletin, |
| American Blacksmith, | American Historical Review, |
| American Breeders' Association, | American Institute of Mining |
| Proceedings, | Engineers, Transactions, |
| American Chemical Journal, | American Journal of Pharmacy, |
| American Chem. Society Journal, | American Journal of Science, |

- American Journal of Sociology,
American Library Society Book-list,
American Machinist,
American Magazine,
American Mathematical Society, Bulletin,
American Mathematical Society, Transactions,
American Naturalist,
*American Philosophical Society, Proceedings,
American Society for Testing Materials, Proceedings,
American Society of Civil Engineers, Transactions,
Annalen der Physik,
Annales des Mines,
Architectural Record,
Archiv. f. d. Studium d. neueren Sprachen,
Association of Engineering Societies, Journal,
Astrophysical Journal,
Athenaeum,
Atlantic Monthly,
Australian Mining Standard,
Biblot.
Biedermann's Zentralblatt fur Agrikulturchemie,
Book Review Digest,
*Bookbuyer,
Bookman,
Botanical Gazette,
Breeder's Gazette,
Bulletin of Bibliography,
*California Cultivator,
*California University, Publications,
Canadian Entomologist,
Canadian Mining Journal,
*Canal Record,
Cassier's Magazine,
Cement,
Centralblatt f. Mineralogie,
Century,
Chemical, Metallurgical and Mining Society of South Africa, Journal,
Chemical News,
Chemical Society, Journal, (London),
Chemisches Centralblatt,
Collier's Weekly,
Country Life in America,
Craftsman,
Cumulative Book Index,
Current Literature,
Deutsche Chemische Gesellschaft, Berichte,
Dial,
Economic Geology,
Educational Review,
Electrical Review,
Electrical World,
Engineering and Mining Journal,
Engineering Index,
Engineering Magazine,
Engineering News,
Engineering Record,
Englische Studien,
English Historical Review,
Espana moderna, La.,
*Farmer's Voice,
Fern Bulletin,
Forum,
Franklin Institute, Journal,
Geological Magazine,
Geological Society of America, Bulletin,
Geologisches Centralblatt,
Graphic,
Harper's Monthly Magazine,

- Harper's Weekly,
Havana University, Revista de
la Facultad de letras y ciencias,
Illustracion espanola y americana,
Independent (N. Y.),
Institut de France, Paris, Academie des Sciences, Comptes
rendus des Seances,
International,
International Studio,
Irrigation Age,
Journal of American Folk-lore,
Journal of Geography,
Journal of Geology,
Journal of Morphology,
Journal of Political Economy,
Ladies' Home Journal,
Life,
Literary Digest,
Living Age,
*Lowell Observatory, Bulletin,
McClure's Magazine,
Machinery,
Manual Training Magazine,
Metallurgical and Chemical Engineering,
Mexican Mining Journal,
Mineral Industry,
Mines and Methods,
Mines and Minerals,
Mining and Scientific Press,
Mining Magazine (London),
*Mining Reporter,
*Mining Review,
Mining Science,
*Mining World,
Missouri Ruralist,
Modern Language Association of America, Publications,
Modern Philology,
Monist,
- Musician,
Nation,
National Geographic Magazine,
Nature,
Neues Jahrbuch f. Mineralogie,
New Age (London),
New York Dramatic Mirror,
Nineteenth Century and After,
North American Review,
*North German Lloyd Bulletin,
*Our Dumb Animals,
Out West,
Outing,
Outlook,
Pacific Monthly,
Philosophical Review,
Philosophical Magazine,
Physical Review,
*Plant World,
Poet-Lore,
Political Science Quarterly,
Popular Astronomy,
Popular Science Monthly,
Power,
Practical Engineer,
*Prairie Farmer,
Public Libraries,
Publishers' Weekly,
Quarterly Journal of Economics,
Queensland Government Mining
Journal,
Readers' Guide to Periodical Literature,
Review of Reviews,
Revue des deux Mondes,
St. Louis Mirror,
School Review,
School of Mines Quarterly,
Science,
Scientific American,
Scientific American Supplement,
Scribner's Magazine,

Societe francaise de Mineralogie,
 Bulletin,
Society for the Promotion of En-
 gineering Education, Proceed-
 ings,
South African Mining Journal,
Spectator (London),
Sunset,
System,
Technical World,
Torrey Botanical Club, Bulletin,

*Western Chemist and Metal-
 lurgist,
World's Work,
Zeitschrift f. analytische chemie,
Zeitschrift fur anorganische
 chemie,
Zeitschrift fur Elektrochemie,
Zeitschrift fur Krystallographie,
Zeitschrift fur physikalische
 chemie,
Zeitschrift fur praktische Geol-
 ogie.

NEWSPAPERS ON FILE IN THE READING ROOM

*Arizona Blade,
*Arizona Bulletin,
Arizona Daily Star,
Arizona Range News,
Arizona Republican,
*Arizona Silver Belt,
Arizona Weekly Journal-Miner,
Bisbee Review,
*Copper Era,
Douglas International,
Los Angeles Times,

*Graham County Guardian,
Mojave County Miner,
New York Times (Saturday ed.)
*Oasis,
Prescott Weekly Courier,
Southwestern Stockmen,
*Tempe News,
Tucson Citizen,
Tucson Post,
Tombstone Epitaph,
*Yuma Sun.

*Donated.

The Carnegie Library of the City of Tucson is also open to the use of the students of the University. This library also is a depository of United States Government documents.

MUSEUM

The professors of the University have the immediate care of the collections pertaining to their respective departments. The collections now displayed at the University comprise representative series of minerals, ores and rocks of Arizona. Among these may be particularly mentioned superb specimens from the mines of the Copper Queen Mining Company at Bisbee. There are also collections of typical rocks and minerals for comparison, and many specimens of ores from different parts of the United States and from abroad. It is

desired to make the collection of ores and minerals fully represent the great mineral resources of Arizona.

The Muesum is indebted to Mr. Herbert Brown, curator, for a large and valuable collection of skins of the birds of Arizona, which he has deposited in the Museum, as well as for a collection of ancient aboriginal pottery and other relics. The fossil skull and teeth of an elephant, and other fragmentary remains of extinct animals, sent from Yuma by Mr. Brown, deserve special mention.

Historical records of much value are gradually accumulating as a part of this museum, and an appeal is made to old settlers and others to bear this fact in mind when making disposition of articles bearing even remote relation to the early pioneers and their history. All records and data of any nature that can be gleaned are worthy of preservation, and it is earnestly desired to have them placed at the University, where they will always be accessible for reference.

AGRICULTURE AND HORTICULTURE

The University demonstration farm consists of eighty acres of Rillito Valley land. Thirty-five acres of this have been cleared; ten acres are seeded to alfalfa. Additional acres will be used for garden crops during the summer of 1912, and the leveling and irrigation of other areas will add to the resources of the farm. An excellent well furnishes water for the farm, a number five Krough pump being run by a twelve horse power gasoline engine.

A farm residence has been constructed at a cost of about \$2,000, which is occupied by the farm foreman and his family. It contains an extra room which may be occupied by students in personal study of experiments.

The farm has recently constructed a horse barn with room for five horses and a work shop at a cost of about \$900; a modern sanitary dairy barn designed to furnish accommodations for 40 cows, at a cost of about \$1,600; a water tank with a capacity of 6000 gallons and a distributing system for the whole ranch, at a cost of \$500. The main distributing ditch for irrigation purposes has been constructed out of cement tile at a cost of \$500, an improvement that will soon

pay for itself in the saving of water otherwise lost by percolation and evaporation.

During the summer of 1912 a dairy herd of pure bred animals has been purchased and also a full equipment for laboratory and farm dairy work.

An agronomy laboratory is well equipped with apparatus for teaching soil physics, and the green houses furnish accommodations for laboratory work in plant culture and other horticultural subjects. Laboratory facilities are also being provided for the use of classes in animal physiology. As soon as funds can be obtained for the purpose it is intended to provide full equipment for laboratory and demonstration work in poultry husbandry.

The section in the University library devoted to agriculture contains all the leading reference works in agriculture, including cyclopaedias, herd books, standard texts, and experiment station bulletins. The student is required to make much of his preparation for class room recitations by consulting the works in this library.

The laboratories of the Arizona Agricultural Experiment Station, located in the main building, together with its plant breeding and plant introduction gardens, located on the University campus, furnish abundant opportunity for students to observe the working out of experimental problems of vital interest to the agriculture of the Territory, while the campus itself, with its many ornamental trees, shrubs, and flowers, all of which are peculiarly adapted to the climate of the arid Southwest, furnishes excellent facilities for the study of problems of ornamentation and home building.

In addition to regular courses of instruction in agriculture and horticulture, "Timely Hints for Farmers," issued under the auspices of the Experiment Station, are of distinct educational value. Three thousand farmers of the Territory are reached more or less regularly by timely publications on subjects of vital interest. Farmers' Institutes, announcements of which are made from time to time, are supplemented by short courses in agriculture.

Small and well selected agricultural libraries of small cost have been forwarded to a considerable number who have expressed a willingness to receive them.

BIOLOGY

The biological laboratories are located on the third floor of Science Hall, in a fine suite of eight rooms, convenient and well-lighted for microscopic work; the equipment is such as is required for modern instruction and research in the biological sciences. The library and apparatus are well selected and adapted to the region and the courses offered.

The collections possessed by the department form a very important part of its equipment. The herbarium consists of 20,000 sheets of mounted plants, of which number 8000 are included in the University botanical survey herbarium. The unique flora and fauna of the mountain, mesa and lowland collecting grounds, in close proximity to the institution, offer very attractive opportunities for instruction and research especially along ecological lines. The Desert Botanical Laboratory of the Carnegie Institution supplements in most admirable fashion the facilities of the University for investigation.

In addition to the above there are fifty cases of insects, a large case of seeds, articulate and disarticulate human skeletons, plaster and papier mache models of the important structures of the human anatomy, and duplicate material for study and dissection.

During the past year several pieces of special apparatus were added to the equipment, including a Leitz rotary microtome, a large paraffin bath, a McIntosh stereopticon and photographic camera. Four new Leitz compound microscopes of the latest pattern were also purchased.

CHEMISTRY

The chemical laboratories used for instruction occupy twelve laboratories, class rooms, storerooms, etc., on the second and third floors of the new Science Hall.

The laboratory used by Freshmen for the study of general chemistry and qualitative analysis is at the east end of the second floor of Science Hall. It was newly furnished throughout during the year 1910-11, with desks, hoods, racks, etc., and piped for both water and gas. It has accommodations for forty-eight students.

The laboratory for quantitative analysis is at the west end of the second floor of Science Hall. It is thoroughly equipped for the teach-

ing of volumetric and gasometric analysis, and metallurgical chemistry, including apparatus for the electrolytic determination of metals. The balance room contains analytical balances of the latest models so arranged as to insure a maximum of stability and accuracy.

A lecture and demonstration room fitted with sinks, cabinets, etc., completes an equipment of apparatus and collections adequate for complete instruction in both theoretical and practical chemistry.

The laboratory of physical chemistry, located on the third floor of the Science Hall, is well equipped with the following apparatus: Wanner's Optical pyrometer, Chateliers pyrometer, boiling point and freezing point apparatus, Pulfrich refractometer, large wave length spectroscope made by Adam Hilper, London, thermostats, polariscope, and apparatus for conductivity work and the determination of electromotive force.

Two small laboratories on the third floor are to be equipped for electro-analysis and advanced work in chemistry.

The laboratories of the Agricultural Experiment Station occupy four rooms on the first floor of the Main Building. These are devoted to analytical work and chemical investigations relating to agriculture. Though not intended for the use of students they are of incidental value to the instructors and students through the investigations which are here conducted.

CIVIL ENGINEERING

The present quarters of this department are a recitation room, an instrument room and office, a materials testing laboratory, and a drafting room. The recitation and drafting rooms occupy the entire east end of the third floor of Science Hall. The materials testing laboratory is in the Shop and Assay Building.

The instrument room contains lockers in which the surveying instruments are kept. These include six transits, four levels, two plane tables, two compasses, a sextant, a considerable number of small instruments, and other equipment required for field work.

The materials testing laboratory is fitted for making physical tests of wood, iron, steel, stone, cement, concrete, and other materials used

in engineering construction. The apparatus includes an Olsen 100,000 pound universal testing machine, a duplex micrometer extensometer, a Fairbanks cement testing machine, briquette molds, cube molds, molds for concrete beams, molds for specimens for testing shearing strength of concrete, a Vicat needle machine, specific gravity flasks, sieves, a moist chamber and other auxilliary equipment.

MECHANIC ARTS

The Shops and Drawing Rooms occupy a total floor area of about 8000 square feet, divided into a large shop and machinery room, with adjacent tool, supply and store rooms; draughting, model, pattern, lecture rooms and office.

The entire building is well ventilated and lighted from above as well as from the sides and is steam heated.

The wood shop is equipped with a full assortment of hand tools, twenty-four benches with a complete set of tools with each, six turning lathes, Beach scroll saw, a Whitney dimension sawing machine, a band saw, a Universal trimmer, and a large grindstone with truing device.

The forge-room contains twenty down-draught forges, twenty anvils, a combination shear and punch, a blacksmith's drill press and a full assortment of small tools and appliances. Blast is furnished by a No. 3 Sturtevant blower; the smoke and gases are removed by a 70-inch exhaust fan.

The machine shop contains one 24-inch Lodge and Shipley engine lathe with taper attachment, two 14-inch Lodge and Shipley lathes, one 14-inch Pratt and Whitney lathe with taper attachment, one 12-inch Seneca Falls lathe with taper attachment, drawing chuck, and English and Metric change gears; one 10-inch Reed speed lathe, one 16-inch Cincinnati shaper, one 24-inch by 6-foot Woodward and Powel planer, one Browne & Sharpe No. 2 Universal milling machine, one Browne & Sharpe No. 1 Universal grinder, one Prentice 24-inch drill press, one 13-inch Slate sensitive drill, one power hack saw, one drill grinder, one emery stand, one grinding attachment for lathes, one $1\frac{1}{2}$ ton portable hoist, one 1-ton triplex hoist, one $\frac{1}{2}$ -ton

screw hoist. Each shop has its own tool room well equipped with small tools, gauges, measuring instruments, etc.

MECHANICAL AND ELECTRICAL ENGINEERING

The department possesses a comprehensive catalogue file containing the trade literature of about five hundred leading manufacturers of this country, together with a large collection of working drawings, and sample collection of models, machine parts, valves, electrical fittings, insulating materials, abrasives, etc.

The mechanical and electrical laboratory is equipped for experimental work in the study and operation of steam boilers, steam and gas engines, hydraulic and electrical machinery. Besides the machinery of the shop and mill which can be used for the study of machine design as well as for experimental work, the University has a 45 horsepower return tubular boiler, a 35 horsepower Atlas center crank engine, a 60 horsepower Chuse high speed automatic side crank engine, to be direct connected to generator, a 30 horsepower Fort Scott engine, a $10 \times 7 \times 10$ Worthington duplex direct acting steam pump, a small duplex pump, a small Cameron boiler feed pump, an injector, a 40 horsepower Fairbanks Morse gasoline engine direct connected to a 500 gallon high pressure fire pump, a 23 k. w. Crocker Wheeler direct current generator, a 5 k. w. Fort Wayne rotary convertor, a 15 horsepower Westinghouse variable speed induction motor, a 7 horsepower Westinghouse induction motor, a 3 horsepower and a $\frac{1}{2}$ horsepower direct current motor, and, for measuring instruments, a 5 k. w. Packard variable voltage transformer, two small testing transformers, two graphic recording volt meters and ammeters, several integrating watt meters, and a series of indicating meters. An 8" x 10" Gould triplex pump with its electric motor serve as part of the equipment of the mechanical-electrical laboratory as well as furnishing the University with its water supply. The department is well equipped with steam indicators, gauges, weighing scales, etc. For the testing of pumping machinery a large steel wier box overflowing into cement cistern, is connected by suitable piping to the various pumps in the laboratory.

METALLURGY

The Mill or metallurgical laboratory, is equipped for testing the adaptability of ores for treatment by different processes both on a large and small scale.

The chief features of the equipment are: a Blake crusher, 4 in. by 7 in.; a Dodge crusher, 4 in. by 6 in.; sampling rolls, 6 in. by 9 in.; a cone and burr sample grinder; a pebble mill with a capacity of about 15 lbs. at one charge; a laboratory lightning crusher and a disc pulverizer; a 5-stamp mill, with 800-pound stamps; a 3-stamp mill, with 250-pound stamps; inside and outside amalgamated plates for the same; a 2-ft. clean-up pan; a 1-ft. amalgamation pan, and a 9-jar revolving agitator for testing samples of a few ounces; a No. 5 Wilfley table of the latest pattern, and a Hallett hand jig; a 1½ ton cyanide plant for treating sands or dry crushed ore; two 150-lb. cyanide plants for treating smaller samples; 3-ft. agitator; a 12-in., 6-chamber, flush plate and frame, washing filter press and pump for the same; a Sturtevant shaking screen; a Tullock ore feeder; a belt and bucket elevator, sampling plates, split samplers, a shaking screen, percolators, sizing screens from 1-mesh to 200-mesh, miners' pans, bateas, retorts, etc.

The power for operating this plant is furnished by a 30 h. p. Westinghouse induction motor, type C.

There has been recently added The Callow Miniature Plant, consisting of: 1 small two-compartment Harz jig, 1 small Wilfley table, 1 amalgamating plate, 1 set hydraulic classifiers, 1 set cyanide agitators, 1 automatic feeder. This plant is driven by a ¼ h. p. motor and stands on a hopper bottom tank divided into three compartments. It is a complete ore dressing plant, gold mill—and together with the cyanide percolators described elsewhere—cyanide mill, and tests quantities of ore ranging in amounts from 25 to 400 pounds. The results from these tests should predict the performance of a full size plant.

The assay laboratory is equipped with assay furnaces for crucible work, for scorifying and cupeling, and for retorting mercury from amalgam, fired with coke, gasoline and gas, so the student becomes trained in the use of all these fuels. There are besides, all needed appliances for assaying by dry and wet method including electrolysis.

The laboratory also has desks and fittings for the chemical work required in the metallurgical and mineralogical investigation and analysis of ores, in mineral fertilizers, and in qualitative tests of minerals.

MINERALOGY AND PETROGRAPHY

The laboratories for mineralogy consist of two rooms on the second floor of the Science Building, one being used for microscopic work in petrography and the other for blowpipe analysis and determinative mineralogy. The laboratory for microscopic work is equipped with seven petrographic microscopes including both American and foreign make, one Zeiss binocular for opaque work, models for illustrating axes of elasticity and spherical projection, a type set of rocks classified according to Rosenbusch's *Elemente der Gesteinlehre* with thin section corresponding, 120 oriented sections of minerals, and apparatus for photo-micrography and projection. The laboratory for blowpipe analysis is well supplied with minerals for making the necessary tests and studying the physical properties. A type set of 600 minerals classified according to Dana is included. For the study of crystallography, there is a collection of 300 pasteboard models of crystals, numerous glass and wooden models, three two-circle contact goniometers and one two-circle reflecting Goldschmidt goniometer of the most recent type, apparatus for the projection and drawing of crystals, and a model machine for cutting crystal models from plaster of Paris.

PHYSICS AND ASTRONOMY

The department of physics occupies the entire first floor of the new Science Hall, where the facilities for the demonstration of all important phenomena are very complete. A lecture room seating forty persons is fitted with every modern convenience, such as lights, water, gas, heliostat, alternating and direct currents of great range, an opaque projection lantern, elevated seats, shutters for darkening the room, etc. Two large main laboratory rooms supply space for mechanical and electrical work, while separate special rooms are devoted to heat, sound, light, magnetism and research work. A carpenter's shop, a repair and store room, a photographic dark and enlarging room, and a constant temperature room are provided. A

pendulum seismograph will be installed in the magnetic laboratory and a special space has been provided for a 55-foot Foucault pendulum and the study of falling bodies.

An eight-inch Willyoung induction coil with storage and X-ray accessories is used in the study of high-tension electricity. This has recently been supplemented by a large Oudin resonator and a mercury interrupter, manufactured by Cox, and a Tesla coil of the Elster and Geitel type. Through the generosity of the Honorable Mark J. Egan, of Clifton, the University added to its equipment for the study of electricity a fine imported set of miniature wireless telegraphy apparatus, capable of transmitting messages about two hundred feet. Also a Knott wireless outfit of $\frac{1}{4}$ -kilowatt power, capable of sending messages about twenty-five miles, is installed. The department is also equipped with three motor generator sets, the largest having an output of 7-kilowatts, with a Leeds and Northrup potentiometer and accessories, and with very complete apparatus for showing electromagnetic phenomena, rotary fields, stationary electric waves, etc.

The astronomical observatory is at the top of the building where a sliding roof, 12 feet square, uncovers the telescope and discloses a clear horizon in every direction. An 8-inch Clark lens and mounting, both of the first quality, loaned to the University by the Observatory of Harvard University, Cambridge, Mass., are mounted on a cement pier supported on the main walls of the building, and give perfectly steady images. This lens is most efficient in fundamental research work. The equipment also includes a four and one-quarter inch Brashear telescope, siderial and mean time clocks and pier for latitude and longitude observation.

GYMNASIUM

Herring Hall, the gymnasium, is fully equipped for the purposes of the department of physical training and athletics. The apparatus is of standard make, and includes forty chestweights, dumb-bells, bar-bells, wands, Indian clubs, Medart vaulting horse, parallel bars, horizontal bar, quarter-circle, abdominal chair, wrestling machine, finger machine, chest expander, chest developer, climbing rope, flying rings, traveling rings, striking bag and drum, jump and vaulting stands,

fencing foils and masks, basket balls and goals, five large mats and a set of anthropometric apparatus.

In the basement are located ninety-six lockers, and five shower baths which are supplied with hot water from a heater with large reservoir.

The outdoor equipment consists of two baseball fields; a football field, six-lap track, and straightaway, at the rear of the gymnasium; five fine tennis courts; and a basketball court for girls.

MILITARY

Room N, in University Hall, is used as an armory. It is fitted up with the necessary gun racks and accessories. The equipment includes 150 old style Springfield rifles, 100 Krag cadet rifles with complete accoutrements, 4 model 1906 Springfield chambered for .22 for indoor practice, eight sabres and belts, musical instruments for the band, and signal flags. A large clear area south of the Library building is kept leveled and smooth for a drill ground and parade ground. At the rear of the Mill building are the targets for short range practice.

Fifteen 10 x 12 army wall tents with poles, etc., and a mess outfit, constitute the camp equipment of the department of military science and tactics for use on practice marches and annual encampments.

COLLEGE OF AGRICULTURE AND MECHANIC ARTS

The courses offered in the College of Agriculture and the Mechanic Arts provide both a liberal training along literary and scientific lines and technical training along engineering, mechanical and agricultural lines. Great latitude of election is given in the literary and scientific courses, but the courses in engineering are more rigid in their requirements. Full details of the various courses follow. The aim in all is to combine the practical with the theoretical instruction. The needs of a young and growing commonwealth are kept in mind, and a steady attempt is made to develop the adaptability and resourcefulness so necessary to meet changing conditions.

SCHOOL OF MINES

The School of Mines is designed for the education and training of young men in the arts and sciences directly involved in the indus-

tries of mining and metallurgy. Especial attention is given to the sciences of mathematics, physics, chemistry, mineralogy, geology and their applications. The Bureau of Mines and Assaying, while not directly connected with the work of instruction, affords with its laboratory and the influx of new material, a valuable object lesson to the advanced students of mining and metallurgy.

REGISTRATION

All students are expected to register on registration day at the beginning of the year and at the beginning of the second semester, in the University office or in such rooms as may be designated on that day. Before making choice of elective subjects the student should in every case confer with the instructors concerned and with the committee on registration. All students are required to pay an annual incidental fee of \$10.00 at the time of registration, and no student will be considered registered and entitled to attend classes unless this fee has been paid. After registration no change in classes can be made without the consent of the President.

Students entering from other institutions should present to the committee certified copies of their records in such schools, together with certificates of graduation or of honorable dismissal. A copy of the school catalogue or course of study should be furnished with the credentials, in order to facilitate the work of the committee.

RECORDS

The class standing of each student is determined by the instructor in charge. The method of ascertaining the student's record is left to the instructor, and his report in all cases is final. In addition to the reports at the end of each semester, which form the permanent records of each student, each instructor makes a monthly provisional report to the office on all students registered in his courses.

DISCIPLINE

The disciplinary policy of the University in all its departments is based upon the assumption that the students are young gentlemen and young ladies who come to the institution with a high determination to

utilize fully the opportunities offered, and with a keen sense of duty, honor and courtesy to each other and to the faculty.

Students or classes desiring to make requests of the faculty should file their petition in the President's office before the hour of faculty meeting; class petitions must be presented at least two days before the time of meeting.

VACATIONS AND HOLIDAYS

A short recess (see Calendar, page 2) is taken at Christmas time. The long summer vacation begins about June first and continues until the middle of September. The Thanksgiving recess extends from the close of the regular exercises on the Wednesday before Thanksgiving to the next Monday morning. During the spring, the cadet companies make a practice march of from three to seven days, which constitutes in reality a third vacation. All legal holidays are observed by the cessation of ordinary University work.

Arbor day has been formally adopted by the University Regents as the regular anniversary on which to celebrate the founding of the institution, in connection with the ceremonies of tree planting.

LIVING ACCOMMODATIONS

Provision is made so far as possible for furnishing board and rooms to students of both sexes upon the University grounds. Young men have comfortable quarters in South Hall, which can accommodate about sixty-five students, two in a room, and in North Hall (for College men only), which can accommodate thirty-two students. Two other halls provide accommodations for young women, under the direction of a capable and experienced preceptress.

All dormitories are lighted by electricity; South Hall is heated by a hot water system, the other dormitories being heated by stoves. Rooms contain a clothes press, and are provided with single bedsteads, tables, chairs, mirror, wash bowl, pitcher, and slop jar. Students will supply their own mattresses, pillows, sheets, blankets, towels, rugs, and brooms, laundry bags, and such other articles as they may desire for ornamenting their rooms. They will care for their own rooms under the direction of the head of each dormitory.

The Dining Hall of the University has accommodations for one hundred students. It is under the management of a paid steward who is responsible to the President and the Board of Regents. While the charge of \$18 per month for board is very low, it is the aim of the management to serve substantial, wholesome, appetizing meals. All students having rooms in the dormitories are required to take their meals at the Dining Hall. Students and members of the faculty who reside outside the dormitories, may board at the Dining Hall.

By resolution of the Board of Regents of the University, board is to be paid in advance on the twelfth of each month. If payment is not made before the fifteenth of each month, \$19.00 instead of \$18.00 will be charged for the month's board. Checks and postoffice or express money orders should be made payable to the President. No reduction in the bill for board will be made for a period less than one week, except by special arrangement at the office, made in advance.

TUITION

Tuition is free to students of Arizona. For all non-resident students, tuition is \$10 for each semester. No reduction will be made for late registration or early withdrawal.

FEES AND EXPENSES

	LOW	HIGH
Tuition free to students from Arizona.....		
Tuition, students non-residents of Arizona, each semester	\$10.00	\$10.00
Incidental fee, paid annually.....	10.00	10.00
Mining excursions for advanced students.....	20.00	40.00
Military uniform, cadet gray.....	16.25	24.00
Military uniform, khaki.....	9.25	12.00
Books, a year.....	5.00	20.00
Board, a month.....	18.00	20.00
Dormitory fee, annual.....	25.00	25.00

LABORATORY FEES

Assaying. See Metallurgy 2.

Botany, 1, 2, 3, 4, each.....	\$ 2.50
Chemistry 1, 2, 3, 4, 5, 6, 7, each.....	15.00

Chemistry 10.....	5.00
Chemistry III (Preparatory year).....	12.00
Civil Engineering 3, 11, 13, 15, 18, 20, each.....	1.00
Civil Engineering 1, 2, 6, 7, 8, 17, 19, each.....	1.50
Civil Engineering 14.....	2.00
Geology 5, 6 (year).....	10.00
Mechanic Arts I, II, 1, 2 (each year).....	1.00
Mechanic Arts—Shop courses, each semester unit.....	1.50
Mechanical and Electrical Engineering, drawing, a year.....	1.00
Mechanical and Electrical Engineering, laboratory, semester..	3.00
Metallurgy 2, (Assaying).....	25.00
Metallurgy 5A, 5B, 6, each.....	10.00
Mineralogy 1, 2, (year).....	15.00
Mineralogy 3, 4, (year).....	5.00
Physics 1, 2, (year), IV (year).....	2.00
Physics 3, 4, 5.....	2.00

Text-books may be obtained directly from the publishers through a book association managed on the co-operative plan under the direction of the faculty.

Members of the cadet companies will be required to provide themselves with the prescribed uniform, which will be ordered by the University. The cost of the cadet grey, woolen uniform, is \$16.25. The uniform has shown better wearing qualities than a civilian suit of equal cost, and parents are urged to consider the matter of uniform when supplying their sons with clothing for the approaching University year. It may be worn on all occasions, and thus will remove the necessity for additional expenditure for outer clothing other than overcoats. When the warm weather of spring comes, the students are expected to purchase the regulation khaki uniform and campaign hat, the total expense being about \$9.25.

ASSISTANCE TO STUDENTS

The University has at present no scholarships with which to aid students who must earn their way. Various positions about the grounds, buildings and laboratories of the University, paying from \$4 to \$20 per month, are filled by students who must be self-supporting.

The number, however, is not large, and preference is given to students from Arizona and to those who have spent time enough in the University to demonstrate that they are earnest, capable, reliable young men, likely to do this outside work and at the same time maintain a good record as students.

The Philo Sherman Bennett scholarship, the income of \$500, for aiding young women to secure an education, is regularly awarded to deserving students. The Federated Women's Clubs of Arizona provide a scholarship of the value of \$75 for the same purpose.

The Students' Loan Fund, now amounting to \$610, gives temporary assistance to deserving students, men or women. The conditions under which loans are made may be ascertained on inquiry of the President of the University.

REQUIREMENTS FOR ADMISSION

Applicants for admission to any department of the University will be required to furnish satisfactory evidence of good moral character, and certificate of graduation or of honorable dismissal from the schools with which they were last connected.

For admission to the Freshman class applicants must be at least sixteen years of age and must satisfy requirements in subjects sufficient to give fifteen credits as described below. A credit is understood to be the equivalent of one study pursued satisfactorily at least four times a week for one year, as ordinarily taught in high schools.

Students coming from approved high schools and preparatory schools, and presenting a detailed official statement of work completed from the principals of such schools, will be excused by the committee on registration from entrance examinations in those subjects covered by the credentials, with the exception of English composition. Other students will be required to pass the entrance examinations.

For admission to the course leading to the degree of Bachelor of Arts or Bachelor of Science, the subjects and credits assigned each are:

English	3	Physics, Chemistry or Bi-
Algebra	1½	ology
Plane Geometry	1	Latin, Greek, French, Ger-
History and Civics.....	1	man or Spanish.....
		Elective
		5½

For admission to the course leading to the degree of Bachelor of Science in Mining Engineering, Civil Engineering, Mechanical Engineering, or Metallurgy, the subjects and credits assigned each are:

English	3	Latin, French, German or
Algebra	1½	Spanish
Plane Geometry	1	Physics
Solid Geometry	½	Elective
		6

For entrance to the course in Mining Engineering applicants must have both Physics and Chemistry. This leaves but 5 electives for such students.

Any student having had Trigonometry, where such credit has not been used for entrance, may waive a credit of two units in the college department upon passing a satisfactory examination in that subject.

For admission to the four year course in Agriculture one may substitute two elective units for the two years of foreign language.

SCOPE OF THE ADMISSION REQUIREMENTS

ENGLISH

English—3 credits. (a) English classics. An acquaintance with the works named below. These works are divided into two classes, those intended for thorough study and those intended for general reading. The portion of the examination devoted to the former class will be upon subject matter, form and structure. In addition the candidate may be required to answer questions concerning the leading facts in those periods of English literary history to which the prescribed books belong. In the portion of the examination devoted to the latter class, the candidate will be required to present evidence of a general knowledge of the subject matter, and to answer simple questions on the lives of the authors. In exceptional cases an equivalent amount of reading and study in other than the prescribed works will

be accepted as a substitute. (b) English Composition. The examination will take the form of a theme of five hundred words on some subject familiar to the candidate and will be a practical test of his ability to express himself in writing clearly and consecutively. No candidate will be accepted whose work is notably defective in point of neatness, spelling, punctuation, idiom, or division into paragraphs. Those found lacking in composition will be required to make good the deficiency at once by tutoring.

No student will be admitted without examination, except on the certificate from his former instructors that the entire requirement has been fulfilled. Substantial equivalents, properly certified, will be accepted.

For thorough study, for 1912: Shakespeare's *Macbeth*, Milton's *Lycidas*, *Comus*, *L'Allegro* and *Il Penseroso*; Burke's *Speech on Conciliation with America* or Washington's *Farewell Address* and Webster's *First Bunker Hill Oration*; Macaulay's *Life of Johnson* or Carlyle's *Essay on Burns*, Tennyson's *Gareth and Lynette* and Other Idylls.

For general reading and practice, selections will be made, at the discretion of the teacher from groups I-VI of College Entrance Requirements in English for 1911-1912.

MATHEMATICS

Algebra— $1\frac{1}{2}$ credits. The work required in Algebra covers the usual fundamental subjects, and extends through quadratic equations, graphical representation of equations, proportion, etc., as given in Wells' Essentials of Algebra, or Wentworth's High School Algebra.

Plane Geometry—1 credit. A year is devoted to the subject. The course is based upon the work outlined in Robbins' or Wentworth's Geometry, with special reference to original exercises and notebook work.

Solid Geometry— $\frac{1}{2}$ credit. A half year is given to this subject. Original exercises and notebook work are required.

HISTORY

To meet the requirement in history the student will be expected to have used, in preparation for each credit, a good textbook, to have

done regular reference work, and to have kept a notebook with outlines, summaries, maps, and topical notes on readings, varying in proportion, according to the advancement of the course.

Ancient History—to the year 800 A. D. 1 credit.

Mediaeval and Modern History of Europe—1 credit.

History of England—1 credit.

History and Government of the United States—1 credit.

LANGUAGE

**Greek*—2 credits. As covered by Gleason and Atherton's *Beginner's Greek Book*; Xenophon's *Anabasis*, four books; Homer's *Iliad*, three books, with composition and the use of Hadley and Allen's or Goodwin's *Greek Grammar*.

**Latin*—2, 3 or 4 credits. As covered by Collar's *First Latin Book* and *Viri Romae*, together with Allen and Greenough's *Grammar* and texts; sight reading; *Caesar*, four books, or an equivalent; Cicero, four orations; Virgil, six books; sight reading from Nepos, Cicero and Gellius; Daniell's or Bennett's *Prose Composition*.

**German*—2 credits. First year: Bacon, *German Grammar*; Storm, *Immensee*; von Hillern, *Hoeher als die Kirche*; other readings. Second year: German Composition; Meyer-Foerster, *Karl Heinrich*; Heine, Poems and *Die Harzreise*; Lessing, *Minna von Barnhelm*; Schiller, *William Tell*.

**French*—2 credits. First year: Frazer and Squair, *French Grammar* (Part 1); Aldrich and Foster, *French Reader*; Labiche and Martin, *La Poudre aux yeux*; Halvey, *L'Abbé Constantin*. Second year: *Grammar* (Part II); Merimée, *Colomba*; Lamartine, *Graziella*; Sand, *La Mare au Diable*; Canfield, *French Lyrics*; Victor Hugo, *Les Miserables* (abridged).

**Spanish*—2 credits. First year: Hill and Ford, *Spanish Grammar*; Worman, *First Spanish Book*; Turrell, *Spanish Reader*. Second year: Johnson, *Cuentos modernos*; Alarcon, *El Capitan veneno*; Galdos, *Marianela*; Valdes, *La Alegria del Capitan Ribot*; Umphrey, *Spanish Composition*.

*The courses offered should include the texts outlined, or an equivalent. Two years of one language must be presented, but one or more years of a second language will be accepted as elective.

SCIENCE

Physical Geography—1 credit or $\frac{1}{2}$ credit. A year or half year of work which should include the principles of the subject, as treated in the best recent textbooks, field and laboratory study, and the interpretation and steady use of topographic and weather maps, charts, etc. This subject may be combined in half-credits with botany, zoology, or physiology, which may in their turn be offered as full credits if it is so desired.

Botany—1 credit or $\frac{1}{2}$ credit. The course should cover a study of the life histories of types from the main groups of plants, and a series of simple physiological experiments. At least two-thirds of the course should consist of laboratory work.

Chemistry—1 credit. A year's course of descriptive chemistry, consisting of both class-room and laboratory work, which should include the more common metals and non-metals and their compounds. A careful record of laboratory experiments should be kept.

Physics—1 credit. Along with the use of one of the standard textbooks the year's course should include continuous and systematic laboratory practice, which should be recorded in a notebook.

ELECTIVES

The electives offered for admission should be chosen from the above subjects or any other subjects ordinarily taught in high schools and accepted by reputable colleges and universities.

ADMISSION TO ADVANCED STANDING

Students coming from other institutions of recognized standing may be admitted to classes above Freshman upon the presentation of properly authenticated certificates of work done, and when so admitted will be credited upon the records of this University with so much of such work as corresponds approximately with the courses required for the desired degree here. Certificates of record should be accompanied by statements of honorable dismissal or leave of absence, and a copy of the register or catalogue showing the content of the credits certified.

ADMISSION FROM ARIZONA NORMAL SCHOOLS

Graduates of the 2-year and 5-year courses in the Tempe and Flagstaff Normal Schools are given a total credit of 32 units in the University, which shall include the cancelling of the requirements in Philosophy, but shall not cancel the requirements in English 1, 2, nor any entrance requirement, the equivalent of which shall not have been fulfilled.

ADMISSION UPON CERTIFICATE

Since the statutes of Arizona provide the course of study in the high schools of the Territory "shall be such as, when completed, shall prepare its students for admission into the Territorial University," the University admits without examination, save in English composition, graduates of approved high schools of Arizona. Diplomas or corresponding credentials from high schools and preparatory schools in other states, accredited by the state universities of such states, will excuse from examinations in subjects covered by such credentials, save in English composition.

Accredited four-years high schools in Arizona:

Bisbee,	Prescott,
Clifton,	Tempe,
Douglas,	Thatcher, Gila Academy,
Globe,	Tucson,
Mesa,	Willcox,
Phoenix,	Yuma.

Credits are accepted also from the Tombstone high school for two years of work.

COURSE OF STUDY AND DEGREES

All facilities and privileges of the University are open to qualified persons of both sexes.

The University offers four-year courses of study leading to the degree of Bachelor of Arts and Bachelor of Science, and to those degrees specialized as shown hereafter. In each course the work

is partly required and partly elective, as described by schedules later. Each student doing full work is required to take not less than fifteen hours of class room work per week. In laboratory work a period of from two to three hours is considered the equivalent of one recitation or lecture hour.

Persons of mature age and with sufficient preparation, who are not candidates for degrees, may be admitted to regular classes as special students, provided, however, that in all such cases they show to the satisfaction of the instructors in charge that they can take the course with profit to themselves and without detriment to the regular class. It is expected that those who desire thus to specialize in mineralogy, assaying, geology or surveying, will have had at least a high school education, or its equivalent, particularly in English, algebra, geometry, physics and chemistry.

The faculty reserves the right to omit classes in any course of instruction unless a suitable number of students register for the course.

Students who complete satisfactorily the required work, and the specified amount of elective work, as shown in the accompanying schedules, will be given the degrees of Bachelor of Arts or Bachelor of Science. The special character of any course of study is indicated by adding to the degree the name of the department, as Bachelor of Science in Mining Engineering.

Military science and tactics and physical training are required during the freshman and sophomore years for all male students, and physical training for female students. If for any reason a student is excused from these exercises, an additional subject having a minimum of three recitation hours per week will be required.

Credit toward degrees is given by means of a unit system which assigns to each course of instruction offered a certain number of units or credits. A unit ordinarily represents one class-room hour per week, or its equivalent of two or three laboratory hours, for one semester. One hundred and thirty-one units, including three units in military science and tactics and physical culture, are required for

*Before registering for electives the student must present to the registration committee, the recommendation of the President or the head of the department concerning the courses selected.

obtaining the degree of Bachelor of Arts and Bachelor of Science. The requirements for degrees in the specialized courses are given below.

Any candidate for a degree may present as part fulfilment of requirements for graduation an acceptable thesis embodying the result of a special study of some subject within the range of the course pursued. The subject and the credit value of the thesis are to be submitted for the approval of the faculty at the opening of the senior year, and the completed thesis must be presented not later than three weeks before Commencement Day.

GROUPS OF SUBJECTS

GENERAL:

English, Philosophy, Mathematics, Military Science, Physical Training.

GROUP A:

Latin, Greek, French, German, Spanish.

GROUP B:

Economics, History, Law, Sociology.

GROUP C:

Agriculture, Astronomy, Botany, Chemistry, Geology, Mineralogy, Physics, Zoology.

GROUP D:

Civil Engineering, Electrical Engineering, Mechanic Arts, Mechanical Engineering, Metallurgy, Mining Engineering.

REQUIREMENTS FOR DEGREES

The units necessary for the different degrees are set forth in the following tabulations:

	Required	Free elective
BACHELOR OF ARTS:		35
English	24	
Philosophy	6	
Mil. Science, Physical Training.....	3	
Group A	32	
Group B	15	
Group C	16	
Total, 131 units.		

BACHELOR OF SCIENCE: 44

English	10
Mathematics	10
French or German	16
Mil. Science, Physical Training.....	3
Group B	8
Group C and D	40

Total, 131 units.

COURSE I**Leading to the Degree of Bachelor of Science in Agriculture
(Agronomy-Horticulture Options)****I YEAR**

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2.....	3
Math. 1 (Alg. and Trig.)	5	Mech. Arts 8 (Carpentry)	2
Mech. Arts 1 (Mech. Drawing)	2	Agr. 4 (Dairying)	3
Agr. 3 (Stock Judging)	3	Agr. 2 (Farm Crops)	3
Agr. 1 (Plant Culture)	3	Elective	4
Mil. Sci.....	$\frac{1}{2}$	Mil. Sci.....	$\frac{1}{2}$
Phy. Tr.....	$\frac{1}{4}$	Phy. Tr.....	$\frac{1}{4}$
			<hr/>
	16 $\frac{3}{4}$		16 $\frac{3}{4}$

II YEAR

Physics 1	4	Physics 2.....	4
Chemistry III.....	4	Chemistry III.....	4
Botany 1	4	Botany 2	4
Mech. Arts 9 (Forge and Metals)	2	Mech. Eng. 14 (Small Power Plants and Machinery)	2
Agr. 5 (Market Gardening) or Agr. 7 (Cereals)	3	Agr. 6 (Plant Breeding)	3
Mil. Sci.....	$\frac{1}{2}$	Mil. Sci.....	$\frac{1}{2}$
Phy. Tr.....	$\frac{1}{4}$	Phy. Tr.....	$\frac{1}{4}$
	<hr/>		<hr/>
	17 $\frac{3}{4}$		17 $\frac{3}{4}$

III YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Agr. 9 (Soil Physics)	4	Agr. 10 (Soil Fertility)	4
Civ. Eng. 19 (Surveying)	3	Civ. Eng. 20 (Irrigation)	3
Agr. 11 (Veterinary Physiology)	3	Agr. 12 (Animal Diseases)	3
Chemistry 1 or Agr. 13 (Pomology)	4	Chemistry 2 or Agr. 14 (Citrus Fruits)	4
Elective	3	Elective	3
	—		—
	17		17

IV YEAR

Chem. 3 (Quantitative Analysis)	4	Chem. 4 (Volumetric Analysis)	4
Or Botany 11 (Plant Pathology)	3	Or Botany 12 (Plant Pathology)	3
Agr. 25 (Agronomy Literature) or Agr. 19 (Small Fruits)	3	Agr. 20 (Horticultural Literature) or Elective	3
Economics 1	3	Agr. 26 (Farm Management)	3
Elective	6	Economics 2	3
	—	Elective	—
	15 or 16		15 or 16
Total, 133 or 135 units.			

COURSE II

Leading to the Degree of Bachelor of Science in Agriculture
(Animal Husbandry—Dairy Options)

I YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	3
Math. 1 (Alg. and Trig.)	5	Mech. Arts 8 (Carpentry)	2
Mech. Arts 1 (Mech. Drawing)	2	Agr. 4 (Dairying)	3
Agr. 3 (Stock Judging)	3	Agr. 2 (Farm Crops)	3
Agr. 1 (Plant Culture)	3	Elective	5
Mil. Sci.	½	Mil. Sci.	½
Phy. Tr.	¼	Phy. Tr.	¼
	—		—
	17¾		17¾

II YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Physics 1	4	Physics 2	4
Chemistry III	4	Chemistry III	4
Zoology 1	4	Zoology 2	4
Mech. Arts 9 (Forge and Metals)	2	Mech. Eng. 14 (Small Pow- er Plants and Machinery) 2	
Agr. 11 (Veterinary Physi- ology)	3	Agr. 12 (Animal Diseases) 3	
Mil. Sci.	½	Mil. Sci.	½
Phy. Tr.	¼	Phy. Tr.	¼
			—
	17¾		17¾

III YEAR

Agr. 15 (Poultry)	3	Agr. 16 (History of Breeds) 3
Civ. Eng. 19 (Surveying) .	3	Civ. Eng. 20 (Irrigation) . 3
Agr. 9 (Soil Physics)	4	Agr. 10 (Soil Fertility) ... 4
Agr. 17 (Animal Breeding) 3		Agr. 18 (Feeds and Feeding) 3
Botany 1	4	Agr. 8 (Milk Production) . 3
	—	
	17	16

IV YEAR

Agr. 21 (Advanced Stock Judging)	3	Agr. 22 (Live Stock Investi- gation)	3
Agr. 23 (Meat Production) 3		Agr. 24 (Animal Husbandry Literature)	3
Economics 1	3	Economics 2	3
Elective	6	Agr. 26 (Farm Manage- ment)	3
	—	Elective	4
Total, 135 units.			—
			16

On page 101 of this Register is given a detailed statement of the Short Course in Agriculture, with the purposes of the Course, requirements for admission, and prescribed studies. The student, however, is advised whenever it is at all feasible, to finish his high school course and register in the University for the four-year course in agriculture, as announced above.

COURSE III

Leading to the Degree of Bachelor of Science in Civil Engineering

I YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	3
Math. 1 (Alg. and Trig.) .	5	Math. 2 (Analytic Geom-	
*Chemistry 1	4	etry)	5
Mech. Arts 1 (Mech.		*Chemistry 2	4
Drawing)	2	Mech. Arts 2 (Descriptive	
Mech. Arts 3 (Wood Shop)	2	Geometry)	3
Mil. Sci.	½	Mech. Arts 4 (Forge Shop)	2
Phy. Tr.	¼	Mil. Sci.	½
	—	Phy. Tr.	¼
	16¾		—
			17¾

II YEAR

Math. 3 (Differential Cal-	Math. 4 (Integral Calculus)
culus)	4
Physics 1	Physics 2
Mech. Arts 5 (Machine	Mech. Arts 6 (Machine
Shop)	Shop)
Civ. Eng. 1 (Surveying) ..	Civ. Eng. 2 (Surveying) ..
Elective	Elective
Mil. Sci.	Mil. Sci.
Phy. Tr.	Phy. Tr.
	—
	17¾

III YEAR

Math. 5 (Analytical Me-	Math. 6 (Analytical Me-
chanics)	chanics)
Astronomy 3	Physics 4 (Electrical and
Elective	Optical Measurements) ..
Civ. Eng. 11 (Hydraulics) 4	Civ. Eng. 14a (Mechanics
	of Materials)

*Students who have not had preparatory or high school chemistry must take, in place of Chemistry, 1, 2, Chemistry III, for which college credit will be given. In this case Mineralogy 1 can not be taken in the third year unless Chemistry 1, 2, is elected in the second year.

III YEAR—CONTINUED

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Civ. Eng. 9 (R. R. Surveying)	2	Civ. Eng. 14b (Materials Laboratory)	1
	—	Civ. Eng. 10 (R. R. Surveying)	2
	16	Elective	3
	—		
IV YEAR			16
Mech. Eng. 3 (Heat Engines)	3	Mech. Eng. 4 (Pumping Machinery)	3
Civ. Eng. 7 (Steel Mill Buildings)	4	Civ. Eng. 6 (Masonry and Concrete)	4
Civ. Eng. 13 (Irrigation) ..	4	Civ. Eng. 8 (Steel Bridges) ..	4
Civ. Eng. 15 (Contracts, Specifications)	2	Civ. Eng. 18 (Sewerage) ..	3
Civ. Eng. 17 (Water Supplies)	2	Elective	2
Bacteriology	1		
	—		
Total, 134 units.	16		16

COURSE IV

Leading to the Degree of Bachelor of Science in Electrical Engineering

I YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	3
Math. 1 (Alg. and Trig.) .	5	Math. 2 (Anal. Geom.) . .	5
*Chemistry 1	4	*Chemistry 2	4
Mech. Arts 1 (Mech. Drawing)	2	Mech. Arts 2 (Descriptive Geometry)	2
Mech. Arts 3 (Wood Shop) 2		Mech. Arts 4 (Forge Shop) 2	
Mil. Sci.	$\frac{1}{2}$	Mil. Sci.	$\frac{1}{2}$
Phy. Tr.	$\frac{1}{4}$	Phy. Tr.	$\frac{1}{4}$
<hr/>		<hr/>	
	16 $\frac{3}{4}$		17 $\frac{3}{4}$

*Students who have not had preparatory or high school chemistry must take, in place of Chemistry, 1, 2, Chemistry III, for which college credit will be given.

II YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Math. 3 (Differential Calculus)	4	Math. 4 (Integral Calculus)	4
Physics 1	4	Physics 2	4
Mech. Arts 5 (Machine Shop)	2	Mech. Arts 6 (Machine Shop)	2
Mech. Eng. 1 (Mechanisms)	2	Mec. Eng. 2 (Machine Design)	2
Civ. Eng. 1 (Surveying)	4	Elective†	5
Met. 1 (Iron and Steel)	1	Mil. Sci.	½
Mil. Sci.	½	Phy. Tr.	¼
Phy. Tr.	¼		
	17 ¾		17 ¾

III YEAR

Math. 5 (Analytical Mechanics)	5	Math. 6 (Analytical Mechanics)	4
Mech. Eng. 3 (Heat Engines)	3	Mech. Eng. 4 (Pumping Machinery)	3
Mech. Eng. 5 (Machine Design)	2	Mech. Eng. 6 (Machine Design)	2
Elec. Eng. 1 (Elements Elec. Eng.)	2	Elec. Eng. 2 (Dynamo-Elec. Machinery)	3
Civ. Eng. 11 (Hydraulics)	4	Civ. Eng. 14a (Mechanics of Materials)	3
	16	Civ. Eng. 14b (Materials Laboratory)	1
		Elec. Eng. 10 (Seminary)	1
			17

IV YEAR

Mech. Eng. 7 (Mechanical Laboratory)	1	Mech. Eng. 8 (Mechanical Laboratory)	1
Elec. Eng. 3 (Electrical Machinery)	2	Elec. Eng. 4 (Electric Traction)	2
Elec. Eng. 5 (Electrical Laboratory)	2	Elec. Eng. 6 (Electrical Laboratory)	2
Elec. Eng. 7 (Electrical Design)	2	Elec. Eng. 8 (Elec. Power Plant Design)	2

IV YEAR—CONTINUED

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Elective	9	Mech. Eng. 12 (Power Stations)	2
	<hr/>	Elective	6
	16		
Total, 134 units.			15

COURSE V

Leading to the Degree of Bachelor of Science in Mechanical Engineering

I YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	3
Math. 1 (Alg. and Trig.)	5	Math. 2 (Anal. Geom.)	5
*Chemistry 1	4	*Chemistry 2	4
Mech. Arts 1 (Mech. Drawing)	2	Mech. Arts 2 (Descriptive Geometry)	3
Mech. Arts 3 (Wood Shop)	2	Mech. Arts 4 (Forge Shop)	2
Mil. Sci.	½	Mil. Sci.	½
Phy. Tr.	¼	Phy. Tr.	¼
	<hr/>		<hr/>
	16¾		17¾

II YEAR

Math. 3 (Differential Calculus)	4	Math. 4 (Integral Calculus)	4
Physics 1	4	Physics 2	4
Mech. Arts 5 (Machine Shop)	2	Mech. Arts 6 (Machine Shop)	2
Mech. Eng. 1 (Mechanisms)	2	Mech. Eng. 2 (Machine Design)	2
Civ. Eng. 1 (Surveying)	4	Elective	5
Met. 1 (Iron and Steel)	1	Mil. Sci.	½
Mil. Sci.	½	Phy. Tr.	¼
Phy. Tr.	¼		<hr/>
	<hr/>		17¾
	17¾		

*Students who have not had preparatory or high school chemistry must take, in place of Chemistry 1, 2, Chemistry III, for which college credit will be given.

III YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Math. 5 (Analytical Mechanics)	5	Math. 6 (Analytical Mechanics)	4
Mech. Eng. 3 (Heat Engines)	3	Mech. Eng. 4 (Pumping Machinery)	3
Mech. Eng. 5 (Machine Design)	2	Mech. Eng. 6 (Machine Design)	2
Elec. Eng. 1 (Elements Elec. Eng.)	2	Elec. Eng. 2 (Dynamo-Elec. Machinery)	3
Civ. Eng. 11 (Hydraulics)	4	Civ. Eng. 14a (Mechanics of Materials)	3
	<hr/> 16	Civ. Eng. 14b (Materials Laboratory)	1
		Mech. Eng. 16 (Seminary)	1
			<hr/> 17

IV YEAR

Mech. Eng. 7 (Mechanical Laboratory)	3	Mech. Eng. 8 (Mechanical Laboratory)	3
Mech. Eng. 9 (Design)	2	Mech. Eng. 10 (Design)	2
Civ. Eng. 7 (Steel Mill Buildings)	4	Mech. Eng. 12 (Power Stations)	2
Elective	8	Elective	7
	<hr/> 15		<hr/> 13

Total, 134 units.

COURSE VI

Leading to the Degree of Bachelor of Science in Metallurgy

I YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	3
Math. 1 (Alg. and Trig.)	5	Math. (Analytic Geometry)	5
Chemistry 1	4	Chemistry 2	4
Mech. Arts 1 (Mech. Drawing)	2	Mech. Arts 2 (Descriptive Geometry)	3
Mech. Arts 3 (Wood Shop)	2	Mech. Arts 4 (Forge Shop)	2
Mil. Sci.	$\frac{1}{2}$	Mil. Sci.	$\frac{1}{2}$
Phy. Tr.	$\frac{1}{4}$	Phy. Tr.	$\frac{1}{4}$
	<hr/> 16 $\frac{3}{4}$		<hr/> 17 $\frac{3}{4}$

II YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Math. 3 (Differential Calculus)	4	Math. 4 (Integral Calculus)	4
Physics 1	4	Physics 2	4
Chem. 3 (Quant. Anal.) ...	4	Chem. 4 (Volumetric Anal.) ...	2
Civ. Eng. 1 (Surveying) ...	4	Civ. Eng. 2 (Surveying) ...	4
Mech. Arts 5 (Machine Shop)	2	Mech. Arts 6 (Machine Shop)	2
Mil. Sci.	$\frac{1}{2}$	Mil. Sci.	$\frac{1}{2}$
Phy. Tr.	$\frac{1}{4}$	Phy. Tr.	$\frac{1}{4}$
	$18\frac{3}{4}$		$18\frac{3}{4}$

III YEAR*

Math. 5 (Anal. Mech'cs) ..	5	Math. 6 (Analytical Mechanics)	4
Mineral. 1 (Blow Pipe Analysis)	2	Mineral. 4 (Descriptive Mineralogy)	4
Civ. Eng. 11 (Hydraulics) ..	4	Civ. Eng. 14 (Materials of Construction)	4
Met. 1 (Introd. to Met.) ..	1	Met. 4-9 (Copper, Lead) ..	4
Met. 7-9 (Ore Dressing) ..	3		
Met. 5b (Met. Lab. Ore Dressing)	1		
Mineral. 3	2		
	18		16

IV YEAR*

Chem. 5 (Special Quant.) ..	2	Chem. 6 (Special Quant.) ..	2
Mech. Eng. 3 (Heat Engines)	3	Elec. Eng. 9 (A. C. and D. C. Machinery)	3
Min. Eng. 1 (Lectures on Mining)	2	Mining Eng. 2 (Lectures on Mining)	2
Civ. Eng. 7 (Steel Mill Bldg's.)	4	Civ. Eng. 6 (Concrete and Masonry Construction) ..	4
Met. 3-9 (Gold, Silver) ...	3	Met. 10 (Concentrator and Smelter Design)	3
Met. 5a (Met. Lab. Gold, Silver)	1	Met. 6 (Thesis)	2
Total, 137 units.	15		16

*Geology 1, 2, may be taken in the third or fourth year by students whose records in preceding work are entirely satisfactory, when authorized by the President or the head of the Department of Metallurgy.

COURSE VII

Leading to the Degree of Bachelor of Science in Mining Engineering

I YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	4
Math. 1 (Alg. and Trig.)	5	Math. 2 (Analytical Geom- etry)	5
Chemistry 1	4	Chemistry 2	4
Mech. Arts 1 (Mech. Drawing)	2	Mech. Arts 2 (Descriptive Geometry)	3
Mech. Arts 3 (Wood Shop)	2	Mech. Arts 4 (Forge Shop)	2
Mil. Sci.	$\frac{1}{2}$	Mil. Sci.	$\frac{1}{2}$
Phy. Tr.	$\frac{1}{4}$	Phy. Tr.	$\frac{1}{4}$
	<hr/> $16\frac{3}{4}$		<hr/> $17\frac{3}{4}$

II YEAR

Math. 3 (Differential Cal- culus)	4	Math. 4 (Integral Calculus)	4
Physics 1	4	Physics 2	4
Chemistry 3	4	Chemistry 4	2
Civ. Eng. 1 (Surveying)	4	Met. 2 (Assaying)	2
Mineral. 1 (Blow-Pipe An- alysis)	2	Civ. Eng. 2 (Surveying)	4
Mil. Sci.	$\frac{1}{2}$	Elective†	2
Phy. Tr.	$\frac{1}{4}$	Mil. Sci.	$\frac{1}{2}$
	<hr/> $18\frac{3}{4}$	Phy. Tr.	$\frac{1}{4}$
			<hr/> $18\frac{3}{4}$

SUMMER COURSE: Min. Eng. 8 (Mine Surveying), 4 units

III YEAR

Math. 5 (Analytical Me- chanics)	5	Math. 6 (Analytical Me- chanics)	4
Mineral. 3 (Crystallo- graphy)	2	Mineral. 4 (Descriptive Mineralogy)	4
Geology 1	4	Geology 2	4

III YEAR—CONTINUED

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Met. 3 (Gold and Silver), and Met. 5a (Laboratory)	4	Elective* from Groups C and D	4
or			
Met. 7 (Ore Dressing), and Met. 5b Laboratory)	4		
Elective* from Groups C and D	2		
	17		

SUMMER WORK: Min. Eng. 7 (4 weeks practical work)

IV YEAR

Min. Eng. 1 (General Mining)	2	Min. Eng. 2 (General Mining)	2
Min. Eng. 3 (Designing) ..	1	Min. Eng. 4 (Designing) ..	1
Min. Eng. 5 (Mining Methods)	1	Min. Eng. 6 (Economics and Mining Law)	1
Geol. 3 (Economic Geology) ..	3	Geol. 4 (Ore Deposits) ..	3
Elective* from Engineering, Geology, and Mining ...	6	Elective* from Engineering, Geology, and Mining ...	6
	13		13

Total, 135 units.

ADVANCED DEGREES

Advanced degrees will be given only for work done in residence, to candidates who have received the Bachelor's degree from this institution or one of similar standing. Thirty units of such work will be required for the degrees of Master of Arts and Master of Science, together with a thesis. The courses in each case will be laid out by those in charge of the departments in which the work for the degree is to be taken, and must be approved by a committee composed of all the heads of departments.

Students who expect to make mining engineering their profession are advised to take a fifth year, or a five-year course, since the four-

years course gives insufficient time for a student to master all the subjects that are essential for the practice of mining engineering.

The requirements for the degree of Engineer of Mines are as follows:

Candidates must have completed the course leading to the degree of Bachelor of Science either in Mining Engineering, or in Metallurgy, as given by the University of Arizona, or the equivalent of either of these courses of some school of recognized standing.

The fifth year's course will consist of not less than 30 units of resident work, which will include (1) all of the following courses, the equivalent of which has not been taken by the candidate: Geology 1, 2, 3, 4, 5, 6, 7; Mineralogy 1, 2, 3, 4; Mining Engineering 1, 2, 3, 4, 5, 6, 7, 8; Metallurgy 1, 2, 3, 4, 5, 7. (2) At least 8 units of graduate work in Mineralogy, Geology, Mining Engineering or Metallurgy. (3) The remainder of the 30 units may be chosen from any of the engineering departments, but should not be of lower grade than Junior work. Six months of work underground and in smelters, with a satisfactory detailed report on the same, will be required. This work may be done during summer vacations.

BIBLIOGRAPHY

In the year 1912-13 the librarian of the University will give instruction in bibliography that students in all courses may gain facility in the use of books and some acquaintance with good library practice. The following is the program of the course:

1. Use of Books and Elementary Bibliography. Classification; card catalogues; the more common reference books; bibliographies, indexes, dictionaries, cyclopedias. Open to freshmen and sophomores. Lectures, exercises, preparation of bibliographies. 2 hours, first semester. 2 units.

2. The Library and the School. Library administration, small school libraries, selection and ordering of books, sales catalogues, library routine. Primarily for students intending to teach. Lectures and practice work. 2 hours, second semester. 2 units.

COURSES OF INSTRUCTION

Courses having odd numbers are regularly given in the first semester; those having even numbers, in the second semester. For the hours of classes the student is referred to the horarium issued near the end of the college year. The subjects are arranged alphabetically.

AGRICULTURE

PROFESSOR R. W. CLOTHIER AND ASSISTANT PROFESSOR W. L.
FOWLER

1. Principles of Plant Culture.

PROFESSOR CLOTHIER

A study of some of the fundamental laws governing the successful culture of plants such as purity and vitality of seeds; the relation of root development to moisture and plant food; the function of stem, leaf, bud, and flower, and conditions governing their normal development; the relation of the plant to light, heat, and cold, and other conditions of environment. Plant propagation, plant manipulation. Lectures and laboratory work. Required of all students in the long courses in agriculture, open to students in short course, and elective to preparatory students.

3 hrs., first semester. 3 units.

2. Farm Crops.

PROFESSOR CLOTHIER

A brief study of cereals and various other farm crops of the United States, and a more detailed study of those that may be grown successfully in Arizona. Origin, history, description, methods of culture, and market demands. Required of all students in the long courses in agriculture, open to short course students, and elective to preparatory students.

4 hrs., second semester. 4 units.

3. Live Stock Judging.

ASSISTANT PROFESSOR FOWLER

Includes the judging of different classes of horses, cattle, sheep and swine. The first part of the work will be the use of the score card, and in the latter part, practice in comparative judging will be given. Animals from the college herd, supplemented by live stock belonging

to neighboring ranchmen and farmers, are used. Required of all students in the long courses in agriculture, open to short course students, and elective to preparatory students. Text: Craig's *Judging of Live Stock*.

3 hrs., first semester. 3 units.

4. Elements of Dairying. ASSISTANT PROFESSOR FOWLER

The lectures and recitations include a study of the secretion and composition of milk and the causes of variation in composition; the Babcock test applied to milk; the various methods of cream raising, including a study of the construction and operation of centrifugal separators; methods of making and marketing butter; proper handling of milk on the farm, etc. The laboratory work includes testing milk and other dairy products, operation of different makes of cream separators, and making butter. Required of all students in the long courses in agriculture, open to students in the short courses, and elective to preparatory students.

3 hrs., second semester. 3 units.

5. Home and Market Gardening. PROFESSOR CLOTHIER

Practical and theoretical training in the general principles underlying successful intensive farming, and detailed study of the various crops grown in the home and market garden with special reference to Arizona conditions. Lectures, laboratory and practice on the farm. Required of students in horticulture. Open to students in the short course.

3 hrs., first semester. 3 units.

6. Plant Breeding. PROFESSOR CLOTHIER

A brief study of the general principles of plant breeding, and a more detailed study of the methods pursued and results obtained by leading plant breeders in the various experiment stations and in private work. Required of all students in agronomy and horticulture.

3 hrs., second semester. Tu Th S, 8:30-9:25. 3 units.

3 hrs., second semester. 3 units.

While cereal culture and grain judging will be the main features of this course it is intended to be a continuation of the work begun in the study of farm crops (agriculture 2) so that in the two courses a

detailed study of all the leading farm crops will be given. Required of students in agronomy.

3 hrs., first semester. 3 units.

8. Milk Production. ASSISTANT PROFESSOR FOWLER

A study of the dairy herd and the production of milk from the standpoint of the practical farmer. The lectures include leading breeds of dairy cattle, their characteristics and adaptations to dairy purposes; the selection, breeding and building up of a dairy herd; calf raising; the dairy barn; feeding for milk production; use of by-products from the dairy. The laboratory work consists of judging the leading dairy breeds as to breed character, dairy type, etc. Open to all students in agriculture who have had agriculture 4. Required of students in animal husbandry. Omitted 1912-13.

3 hrs., second semester. 3 units.

9. Soil Physics. PROFESSOR CLOTHIER

Origin, composition and classification of soils; soil temperature and conditions influencing it; soil texture and soil structure as related to tillage, moisture and plant food; various culture methods based on physical properties of soils; irrigation and drainage; mechanical analysis. Required of all students in the long courses in agriculture. Open to short course students.

3 lectures and one 3 hour laboratory period, first semester. 4 units.

10. Soil Fertility. PROFESSOR CLOTHIER

The amount and availability of the various elements of plant food in soils; the relation of humus to soil fertility; commercial fertilizers and their application; control of alkali; making and using farm manures; crop rotations; the Rothamstead experiments; the theory of toxic substances in soils. Required of all students in the long courses in agriculture. Lectures and laboratory work.

3 lectures and one 3 hour laboratory period, second semester. 4 units.

11. Veterinary Physiology. ASSISTANT PROFESSOR FOWLER

Special physiology of farm animals. Lectures and recitations supplemented by practical experiments in the laboratory. Text: Smith's

Veterinary Physiology. Required of all students in the long courses in agriculture.

3 hrs., first semester. 3 units.

12. Animal Diseases.

ASSISTANT PROFESSOR FOWLER

(a) A study of the general and specific causes of diseases and methods of prevention; errors in feeding and care of animals; sanitation of stables, feeding pens and pastures; preventive inoculation; tuberculin test and veterinary regulations. (b) Diagnosis and treatment of common ailments of farm animals. (c) Simple surgical operations; control of hemorrhage, dressing of wounds, care of the teeth, care of the feet, castration, spaying and caponizing; correction of malpositions and removal of placenta in obstetrical cases, etc. Text-books: Reynolds' *Veterinary Studies*, Mayo's *Care of Animals*. Prerequisites: Zoology 1, Veterinary Physiology, and the student must be registered in Chemistry I or Chemistry III, and in Zoology 2. Lectures recitations and clinics. Required of all students in the long courses in agriculture.

3 hrs., second semester. 3 units.

13. Pomology.

PROFESSOR CLOTHIER

Orchard management, and a detailed study of deciduous fruits, including planting, cultivation, pruning, spraying, and description and history of varieties. Attention will be given to fruit judging. Lectures and laboratory work. Open to students in agronomy in the junior year. Required of students in horticulture.

4 hrs., first semester. 4 units.

14. Citrus Fruits.

PROFESSOR CLOTHIER

A detailed study of the culture of citrus fruits with special reference to the citrus districts in the United States. Citrus nursery management; citrus orchard management; citrus insects and diseases; packing and marketing; judging. Open to students in agronomy in the junior year. Required of students in horticulture. Lectures and Laboratory work.

4 hrs., second semester. 4 units.

15. Poultry Husbandry. ASSISTANT PROFESSOR FOWLER

The general care and management of poultry, production of poultry for the market, diseases and pests, breed characteristics. Recitations, lectures and laboratory work including visits to specialized poultry ranches. Required of students in animal husbandry, open to short course students and elective to preparatory students.

3 hrs., first semester. 3 units.

16. History of Breeds. ASSISTANT PROFESSOR FOWLER

The characteristics of each breed of horses, cattle, sheep, swine and goats are considered at length, and each breed is discussed with reference to its origin, history and development, introduction to America and adaptability to Arizona conditions. Required of students in animal husbandry, open to short course students and elective to preparatory students. Textbook: Plumb's *Breeds of Farm Animals*.

3 hrs., second semester. 3 units.

17. Animal Breeding. ASSISTANT PROFESSOR FOWLER

The principles of breeding, including selection, heredity, atavism, reversion, variation, correlation, with a presentation of methods of breeding, such as line breeding, in-breeding, in-and-in breeding, cross breeding, etc. Open to students above the sophomore year in college. Required of students in animal husbandry. Text: Davenport's *Principles of Breeding*.

4 hrs., first semester. 4 units.

18. Feeds and Feeding. ASSISTANT PROFESSOR FOWLER

The principles of animal nutrition; composition and digestibility of various feeds; construction and use of silos; balanced rations; economical feeding of animals for various purposes. Prerequisites: chemistry III and veterinary physiology. Required of students in animal husbandry. Elective to students in agronomy and horticulture.

4 hrs., second semester. 4 units.

19. Small Fruits. PROFESSOR CLOTHIER

A detailed study of the small fruits such as the strawberry, the grape and the various bush fruits. Required of students in horticulture.

ture. Elective to students in agronomy and animal husbandry.

3 hrs., first semester. 3 units.

20. Horticultural Literature.

PROFESSOR CLOTHIER

Throughout the course in horticulture the student will be frequently referred to standard works and to bulletins dealing with special investigations. This course is intended to round out the knowledge thus gained by assigning certain readings in bulletins and standard works upon horticulture upon which the student is required to make daily and weekly reports, which will give him a comprehensive view of the general field of horticulture and lay the foundation for research work. Required of students in horticulture.

3 hrs., second semester. 3 units.

21. Advanced Live Stock Judging. ASSISTANT PROFESSOR FOWLER

Show yard judging; relation of pure bred live stock to market classes; method of comparative judging. Trips are made to large herds and students are required to spend several days at the State Fair at Phoenix, judging live stock. Prerequisites: Live Stock Judging 3, and History of Breeds 16. Required of students in animal husbandry. Elective to students in agronomy and horticulture.

3 hrs., first semester. 3 units.

22. Live Stock Investigations.

ASSISTANT PROFESSOR FOWLER

A survey of live stock conditions. Advanced studies of special phases of animal production. Required of students in animal husbandry. Omitted 1912-13.

3 hrs., second semester. 3 units.

23. Meat Production.

ASSISTANT PROFESSOR FOWLER

Practical methods of producing cattle, sheep and swine, including a consideration of successful practices in feeding for market, fitting of show and sale, etc. Required of students in animal husbandry.

3 hrs., first semester. 3 units. Omitted 1912-13.

24. Animal Husbandry Literature.

ASSISTANT PROFESSOR FOWLER

A study of books, magazines and a review and compilation of bulletins devoted to animal husbandry. The student will be required to use the herd books of the different breeders' associations in studying

the pedigrees of the best individuals in the more popular breeds of horses, cattle, sheep and swine. Required of students in animal husbandry.

3 hrs., second semester. 3 units.

25. Agronomy Literature.

PROFESSOR CLOTHIER

Daily and weekly reports upon assigned readings in bulletins and standard works. Designed to round out the student's knowledge of the general field of agronomy, and to prepare the way for research in the subject. Required of students in agronomy. Elective to students in horticulture and animal husbandry.

3 hrs., first semester. 3 units.

26. Farm Management.

PROFESSOR CLOTHIER

This course will deal with the purchase, organization, equipment and management of farms with reference to financial returns. Farm accounts, market demands, marketing associations, the farm lay-out, farm buildings, leveling for irrigation, location and management of ditches, etc., are among the subjects to be discussed. Required of students in all long courses in agriculture.

2 lectures and one 3-hour laboratory period, second semester. 3 units.

ASTRONOMY

PROFESSOR DOUGLASS

The atmosphere of southern Arizona is perhaps the best in the United States for astronomical observation, having smaller percentage of cloud and less average wind velocity than any other locality where records have been preserved. The dry air and 2400 feet elevation give Tucson such a clear sky that faint stars may be watched till they set behind the distant horizon; the fine weather, day after day, gives opportunity for consecutiveness of observation not obtainable elsewhere; a greater portion of the year is available, with less interference from air currents.

The course in astronomy is arranged especially to draw attention to these advantages, and, at the same time, to give that understanding of the motions of the earth and planets which is so important in many

branches of engineering. The eight-inch Harvard telescope with its Clark glass and the four and one-fourth inch Brashear telescope of the University will always be available for closer study of the heavenly bodies. Two excellent clocks with electric connections for transmitting time give opportunity for longitude, latitude and time observations. It is hoped in the coming year to install other instruments that will take advantage of the exceptionally favorable conditions so peculiar to Arizona.

1. 2. Descriptive Astronomy.

PROFESSOR DOUGLASS

The study of the sun, moon, and planets and other celestial objects, with constant views of their telescopic appearance, and discussion of the latest theories of the evolution of the universe and the condition of the planets. Non-mathematical; open to all students.

2 hrs., or an equivalent, first and second semesters. 2 units, each semester.

3. Engineering Astronomy.

PROFESSOR DOUGLASS

Latitude, longitude, and time observations, and their reductions, with practice work; astronomical measurements; adjustment and handling of instruments. Course 3 is required of juniors in civil engineering.

3 hrs., or an equivalent, first semester. Two day hours and one evening hour. 3 units.

BOTANY

PROFESSOR THORNBER, MR. BROWN

The courses which follow, revised for 1911-1912, are calculated to articulate with the work done in biology in the average western high school.

1. Elementary Botany.

MR. BROWN

This course presents a general view of the four great groups of plants. It includes the morphology of types and their genetic relations. A required course for further botany. Texts: Bergen and Davis, *Principles of Botany*; Coulter, *Plant Studies*.

2 hrs. and 4 hrs. of laboratory work, first semester. 4 units.

2. Plant Histology.**MR. BROWN**

Lectures on microscopy, botanical microtechnique, the use of the camera lucida, the photographic camera. In the laboratory the greater part of the semester is given over to the use of the various chemical reagents and stains in the preparation of microscopic slides. This course is given for those who intend to teach botany and for those who are preparing to take advanced courses in this department. Text: Chamberlain, *Methods in Plant Histology*. Prerequisite, Botany 1.

1 hr. of lecture and 6 hrs. of laboratory work, second semester.
4 units.

3. Plant Physiology.**MR. BROWN**

An elementary course in the life processes of plants. The laboratory work consists of an investigation of the properties of protoplasm; the relations of plants to mechanical forces; the influence of chemicals upon plants; the relation of plants to water, gravitation, light, respiration, growth, and movement. The laboratory, which is newly equipped, is situated in the center of a region most interesting to the physiologist. Text: MacDougal, *Textbook of Plant Physiology*. Prerequisite, Botany 1.

1 hr. of lecture and 7 hrs. of laboratory work, first semester. 4 units.

4. Taxonomy.**MR. BROWN**

A course consisting of the analysis of plants in the field. During the semester several excursions are made to the mesas, mountains and canyons. This course is intended not only for students who expect to continue the study of botany, but also for those who desire to know something of the desert flora. Text: Coulter and Nelson, *A New Manual of Rocky Mountain Botany*. Open to all college students.

1 hr. of lecture and 6 hrs. laboratory work, second semester. 4 units.

5. Geographic Botany.*MR. BROWN**

Plant distribution over the surface of the earth, with the reasons for such distribution. The general aspect of the vegetation characteristic of the hygrophytic forest, the tropophytic forest, the sclerophyll

*Omitted 1912-1913.

forest, the savannah, the steppe, the desert, the tundre, etc. The student is expected to do a considerable amount of reading in addition to the class room and field work. The lectures will frequently be illustrated. No laboratory work. Prerequisite, Botany 4.

4 hrs., first semester. 4 units.

*6. General Morphology of Algae and Fungi. MR. BROWN

Open to college students who have completed courses 1 and 2. Consult the instructor before registering. Prerequisites, Botany 1, 2.

Hours to be determined. 4 units.

*7. General Morphology of Bryophytes and Pteridophytes. 4 units.

*8. General Morphology of Spermatophytes. 4 units.

*9. History of Botany.

A lecture course dealing with: (a) early descriptive botanists; (b) the period of artificial systems; (c) the beginning and development of modern botany; (d) botany and botanists of today. This course requires library work. Prerequisites, Botany 1, 2, 3, 4, 5. 4 units.

†11. Plant Pathology.

A study of the principal groups of parasitic fungi and the plant diseases caused by them, together with the methods of investigation and control. Attention is given to external factors producing pathological conditions in plants. Prerequisites, Botany 1 and 3.

1 hr. lecture and 5 hrs. laboratory work, first semester. 3 units.

†12. Plant Pathology.

Continuation of course 11. First semester, 3 units.

13. Bacteriology.

General bacteriology. Preparation of media, sterilization of media and apparatus; cultivating, staining and studying bacteria; examination of air, water, soil; principles of disinfection.

CHEMISTRY

PROFESSOR GUILD, ASSISTANT PROFESSOR TATARIAN AND MR. KLEEBERGER

The instruction in chemistry has two main objects in view: first, to promote general culture; and second, to introduce students to

*Omitted 1912-13. †Omitted 1911-12.

technical work, especially in mining. The first two years' work in general chemistry, qualitative and quantitative analysis, places the student in a position to take up advantageously the study of mining, agricultural chemistry or metallurgy.

1, 2. General Chemistry and Qualitative Analysis.

PROF. GUILD, ASST. PROF. TATARIAN, MR. KLEEBERGER

Lectures and recitations illustrating the chemical properties of the elements and their compounds. Textbooks: Smith, *General Chemistry for Colleges*; Elliot and Storer, *Qualitative Analysis*, and various reference books. Open to all students who have taken courses amounting to one year each in preparatory chemistry and physics.

2 hrs. and two 3-hr. laboratory periods, both semesters. 4 units, each semester.

3. Quantitative Analysis. ASSISTANT PROFESSOR TATARIAN

Laboratory practice, with lectures and recitations; the work will be chiefly in gravimetric methods of analysis. For students in agriculture, special problems in agricultural chemistry, such as analysis of water, soils, and fertilizer will be considered. Open to all students who have taken Chemistry 2.

4 hrs., or an equivalent, first semester. 4 units.

4. Volumetric Analysis. ASSISTANT PROFESSOR TATARIAN

A continuation of the work in Chemistry 3, special attention being given to the methods of wet assaying employed in the West.

4 hrs., or an equivalent, second semester. 2 units if discontinued March 15th; otherwise, 4 units.

5, 6. Special Quantitative Analysis. PROF. GUILD OR ASSISTANT

The analysis of water, gases, oils, minerals. Open to students who have taken Chemistry 4.

4 hrs., or an equivalent, both semesters. 4 units, each semester.

***7, 8. Organic Chemistry.** PROFESSOR GUILD

Lectures on the carbon compounds; laboratory work in organic

*Omitted 1911-1912.

analysis and the preparation of organic compounds; vapor density and molecular weight determination. Open to students who have taken Chemistry 3, 4.

4 hrs., or an equivalent, both semesters. 4 units, each semester.

9. Synthetic Chemistry.

PROFESSOR GUILD

The preparation of pure chemical compounds from the crude mineral products. Open to students who have taken Chemistry 4.

2 hrs., or an equivalent, first semester. 2 units.

10. Physical Chemistry.

PROFESSOR GUILD

Lectures. Historical introduction leading up to a discussion of modern chemical theories. Open to students who have taken Chemistry 3.

4 hrs., second semester. 2 units.

***11, 12. Chemistry of the Rare Elements.**

PROFESSOR GUILD

The analysis and synthesis of uranium, molybdenum, tungsten, vanadium and cerium compounds. Open to students who have taken Chemistry 6, 9.

4 hrs., or an equivalent, both semesters. 4 units, each.

CIVIL ENGINEERING

PROFESSOR WATERBURY, MR. MOORE

The courses in this department have been arranged with special reference to the engineering development of the Southwest. Stress is laid on surveying, railroad and structural work, and irrigation engineering. The design throughout the courses is to give the student a thorough and practical knowledge of the essential principles of his profession, and to teach the technical practice of the times, so far as possible, without sacrificing in other directions.

Some of the courses in civil engineering are offered on a consultation basis. For such courses the class will not meet in a body and therefore class periods will not be scheduled. Each student will arrange with the instructor for the required consultation periods. In

*Omitted 1911-1912.

general, two or three consultation periods per week, in each subject, will be required of each student. For courses requiring laboratory or drafting work the student must spend as much time in the laboratory or drafting room as may be required to complete the assigned work.

1. Elementary Surveying. PROFESSOR WATERBURY, MR. MOORE

Use and care of surveying instruments, United States system of land surveys, city surveys, computations. Lectures, recitations, drawing, and fieldwork. Textbooks, Tracy's *Plane Surveying*, and Pence and Ketchum's *Surveying Manual*. Open to students who have taken trigonometry, and who have taken or are taking Mechanic Arts 1.

4 hrs., first semester. 4 units.

2. Topographic and Mine Surveying.

PROFESSOR WATERBURY AND MR. MOORE

A continuation of the work given in Civil Engineering 1. The work of the second semester includes topographic surveying, hydrographic surveying, patent surveys, and underground surveying. Open to students who have taken Civil Engineering 1.

4 hrs., second semester. 4 units.

3. Geodesy. Omitted 1911-12.

PROFESSOR WATERBURY

A study of precise triangulation work, including the measurement of base lines, measurement of angles, adjustment and computation of triangulation systems, and the adjustment of precise level circuits. Open to students who have taken Civil Engineering 1, 2, and Astronomy 3 or 4. This course may be taken as a consultation course.

1 hr., first or second semester. 1 unit.

6. Concrete and Masonry Construction.

PROFESSOR WATERBURY

The theory and practice in reinforced concrete construction. Foundations on land and in water, cofferdams, cribs, caissons, piers, and abutments, retaining walls, dams, and arches. Textbook, Baker, *Masonry Construction*. Open to students who have taken Civil Engineering 14. This course may be given as a consultation subject.

2 hrs., and two 3-hr. laboratory and drafting periods, second semester. 4 units.

7. Steel Mill Buildings.**PROFESSOR WATERBURY**

Graphical and analytical computation of stresses in roof and bridge trusses; a study of the details of structural steel designing; complete design with drawings, estimate of weights, and estimate of cost for a steel mill building. Text-book: Ketchum, *Steel Mill Buildings*. Open to students who have taken Civil Engineering 14. This course may be given as a consultation subject.

2 hrs., and two 3-hr. drafting periods, first semester. 4 units.

8. Bridge Design.**PROFESSOR WATERBURY**

Computation of stresses due to moving loads upon various points of bridge structures; a detailed study of bridge designs and bridge erections; complete investigation with drawings, estimate of weights, and estimate of cost of a steel bridge. Text-book: Ketchum, *Design of Highway Bridges*. Open to students who have taken Civil Engineering 7. This course may be given as a consultation subject.

2 hrs., and two 3-hr. drafting periods, second semester. 4 units.

9, 10. Railroad Engineering.**PROFESSOR WATERBURY**

Preliminary and location surveys; simple and easement curves, turnouts and switches; principles of economic location as based upon cost of construction, operating expenses, alignment, and grades; maintenance of way. The fieldwork consists of the surveys for a railroad of sufficient length to secure familiarity with the methods of actual practice. Each student makes a complete set of notes, maps, profiles, calculations and estimates of cost. Text-book: Allen, *Railroad Curves and Earthworks*. Open to students who have taken Civil Engineering 1, 2.

1 hr., and one 4-hr. field period, both semesters. 2 units, each semester.

11. Hydraulics.**PROFESSOR WATERBURY**

Velocity and discharge from orifices, weirs, tubes, and pipes; flow in sewers, ditches, canals and rivers; measurement of water power;

water wheels of various types. Text-book: Merriman, *Hydraulics*. Open to students who have taken Civil Engineering 1, 2 and Mathematics 4.

4 hrs., first semester. 4 units.

13. Irrigation Engineering. PROFESSOR WATERBURY

A study of the engineering principles relating to the construction and maintenance of canals and reservoirs and the various means of diverting, measuring, and pumping water for use in irrigation. Text-book: Wilson, *Irrigation Engineering*. Open to students who have taken Civil Engineering 1, 2, 11, 14.

3 hrs., and one 3-hr. laboratory and drafting period. This course may be given as a consultation subject. First semester, 4 units.

14a. Mechanics of Materials. PROFESSOR WATERBURY

The analysis and computation of stresses in prisms, beams, columns, and shafts. Text-book: Merriman, *Mechanics of Materials*. Open to students who have taken or are taking Mathematics 5, 6.

3 hrs., second semester. 3 units.

14b. Materials Testing. PROFESSOR WATERBURY

Laboratory work in the testing of materials used in engineering construction, including cement, concrete, wood, iron, and steel. Open to students who are taking or have taken Civil Engineering 14a.

One 3-hr. laboratory, second semester. 1 unit. 2 units additional may be elected, hours to be arranged.

*15. Contracts and Specifications. PROFESSOR WATERBURY

The essential elements of a contract; items included in various kinds of engineering contracts and specifications; the preparations of a complete set of specifications and a contract. Text-book: Johnson, *Engineering Contracts and Specifications*. Open to all college students. This course may be given as a consultation subject.

2 hrs., first semester. 2 units.

*Offered 1911-12 and alternate years.

16. Thesis.†

PROFESSOR WATERBURY

Assigned work on an investigation, design, or original research. No student will be permitted to register in this subject unless his previous work has been of high grade. Open to senior students in civil engineering.

First or second semester. 2 units.

*17. Public Water Supplies.

PROFESSOR WATERBURY

Methods of investigation of available supplies of use, including a study of results of chemical analysis of water, and the bacterial examination of water;‡ methods of purification of water; and a study of the design of water systems. Text-books: Turneaure and Russell, *Public Water Supplies*. Open to students who have taken or who are taking Civil Engineering 11. This course may be given as a consultation subject.

2 hrs., first semester. 2 units.

*18. Sewerage.

PROFESSOR WATERBURY

Methods of sewerage purification; a study of sewerage disposal plants; and a study of the design of sewer systems. Text-book: Folwell, *Sewerage*. Open to students who have taken or are taking Civil Engineering 11. This course may be given as a consultation subject.

3 hrs., first or second semester. 3 units.

19. Agricultural Surveying.

MR. MOORE

An elementary course in surveying for students in agriculture. The work includes a study of the construction and use of surveying instruments, and a study of surveying operations which have particular application in agricultural and irrigation work. Text-book: Pence and Ketchum, *Surveying Manual*. Open to students who have had high school or preparatory algebra.

2 hrs. and one 3-hr. field period, first semester. 3 units.

*Omitted 1912-13.

20. Principles of Irrigation.

MR. MOORE

A study of methods of irrigation, measuring water for use in irrigation, present condition of irrigation development in the United States, irrigation legislation, and methods of establishing water rights. Open to students who have had Civil Engineering 19.

2 hrs. and one 3-hr. laboratory period, second semester. 3 units.

22. Highway Engineering.

PROFESSOR WATERBURY

Highway location and construction; construction of city pavements; bituminous materials for dust prevention and road preservation. Pre-requisite, Civil Engineering 1. 2 hrs., second semester. 2 units.

Given in 1912-13 and in alternate years.

ECONOMICS

PROFESSOR CHANDLER

1. Principles of Economics.

PROFESSOR CHANDLER

A study of the main principles which underlie the science. Special emphasis is placed upon practical illustrations drawn from business activities of today. The text used is *Outlines of Economics*, by Ely, Adams, Lorenz, and Young. Open to sophomores and upper class men.

3 hrs., first semester. 3 units.

2. American Business and the Tariff Question.

PROFESSOR CHANDLER

A study of the rise of the factory system in the United States, and the origin and development of the leading American industries of to-day. The history of the tariff from 1789 to 1911 and its relation to the development of agriculture, manufacture and commerce. Special topics dealt with are: trusts in their relation to high protection; bearing of the tariff upon increased cost of living; conservation of natural resources in relation to the tariff; high protection and decline in American shipping; needed tariff reform; reciprocity; the tariff commission. Open to all college students who have had economics 1.

3 hrs., second semester. 3 units.

3. Industrial Organization.**PROFESSOR CHANDLER**

A study of the scientific basis of large scale industry by analyzing the principles of competition, combination, monopoly and the savings of integration. The following are also studied:

The various business units from the point of view of their comparative efficiency for different kinds of business.

Methods of business consolidation; pools; trusts; holding companies; mergers; agreements; community of interest.

Scientific management and elements of costs.

2 or 4 hours, first semester. 2 or 4 units.

4. Transportation and Commerce.**PROFESSOR CHANDLER**

Three phases of transportation are studied:

1. The rise of the American railway system, and its past and present relation to the development of agriculture, manufacturing, and other industries.

2. The present American railway system—its business organization, methods of combination and financial operations.

3. Relation of the railroad to the government and the public; rights of the shipper and the investor in railway securities; the Interstate Commerce Commission and Federal control of commerce; proposed reforms in State and Federal regulation, including a study of government ownership in Europe and Australia, with a discussion of its practical value if applied to American conditions. Open to all college students who have had Economics 1. Students taking this subject for credit in the general commerce course are required to do work in the materials of commerce necessary for two extra units of credit.

2 hrs., second semester. 2 units.

5. Corporation Organization and Finance. **PROFESSOR CHANDLER**

A study of the business side of the corporation, including:

1. Organization and management; how and where to organize; powers and privileges of corporations in the different states; minority rights.

2. Business development and promotion of various properties and enterprises, with special reference to the promotion and development of mining companies.

3. Financial agents and institutions; stock brokers; stock exchanges; stock market; money market; function of Wall Street.

4. Investments of securities; methods and laws of investment and speculation; relative merits of railway stocks, bonds, municipal bonds, industrial, irrigation and mining securities.

2 or 3 hrs., first semester. 2 or 3 units.

6. Money, Banking and Finance. PROFESSOR CHANDLER

The functions of money and its relation to credit institutions; the monetary system of the United States; the theory and history of banking; function of the savings bank, the trust company, the clearing house, etc.; history of American finance, and financial crises in their relation to our present currency and banking systems; the examination of the principal banking systems of the world with a view to finding ideas which, if applied to American conditions, would render our system more nearly conformable to our growing financial and commercial needs. Open only to juniors and seniors who have had at least one year of economics.

2 or 3 hrs., second semester. 2 or 3 units.

***7. Introduction to the Study of Society. PROFESSOR CHANDLER**

2 or 3 hrs., first semester. 2 or 3 units.

***8. Elements of American Politics. PROFESSOR CHANDLER**

2 or 3 hrs., second semester. 2 or 3 units.

9. Labor Problems. PROFESSOR CHANDLER

The study of the labor question in the first semester is divided into four parts:

1. Origin of the labor problem and history and growth of labor organizations.

2. Economic and social condition of the working classes in the United States and Europe today, including study of child and woman labor; immigration and its relation to wages and the standard of

*Not given in 1912-13.

living of American workmen; sweating system; poverty and unemployment.

3. Conflict of organized labor vs. organized capital; strikes and lockouts; the closed vs. the open shop; the secondary boycott; collective bargaining, etc.; employers' organizations.

4. Political and legal aspects; the use and abuse of the injunction; state in relation to labor; police power; recent court decisions; the laborer in politics.

2 or 3 hrs., first semester. 2 or 3 units.

10. Economic Reform Movements. PROFESSOR CHANDLER

This course logically follows Economics 9. It continues the study of the labor question with emphasis placed upon the constructive side. The chief proposals for the solution in America, Europe and Australia are studied, including: profit sharing; co-operation; industrial education; compulsory arbitration; labor legislation in the United States, etc.

2 or 3 hrs., second semester. 2 or 3 units.

11. Business Principles and Economics. PROFESSOR CHANDLER

In the first semester a study is made of several economic aspects of business including Insurance and Taxation.

The second semester is devoted to the study of business co-operation and economic phases of agricultural production, such as marketing, economics of irrigation, factors of production, farm credits, etc.

3 hrs., each semester. 3 units.

12. Discussion of Public Questions. PROFESSOR CHANDLER

The purpose of this course is to give students training in the handling of public questions, political, economic and social, by means of discussions and debates. Open to all college students.

1 hr., first semester. 2 units.

13. Elementary Accounting.

2 hrs., both semesters. 2 units, each semester.

ELECTRICAL ENGINEERING

PROFESSOR HENLEY AND MR. SNOW

The object of the course in electrical engineering is to furnish

thorough instruction and practical training in applied electricity and allied subjects. The course is designed to train the student in those fundamental principles of science of which a broad knowledge is necessary to form the basis of successful specialization. The laboratory work is designed to supplement the lecture and recitation work in training the student to see the close relation between theory and the actual operation, and to encourage individual judgment rather than the mere development of skill.

The work in electrical engineering proper does not commence until the first semester of the Junior year, but a course in electricity and magnetism may be elected in Sophomore year. Besides the electrical work courses are given in other engineering subjects, and the electives give opportunity for work along non-engineering lines.

1. Elements of Electrical Engineering.

MR. SNOW

A general elementary study of the principles of electrical engineering. Taking up a brief history of the development of the electrical industry, including the modern applications of electricity to transmission of power, electric lighting, the telephone, street cars, etc. The theory of the generation and transmission of both direct and alternating currents, the advantages and disadvantages in the use of both.

2 hrs., first semester, junior year. 2 units.

2. Dynamo-Electric Machinery.

MR. SNOW

This course is in part a continuation of E. E. 1. It includes the study of electric illumination, comparing the various light sources, their relative values under different conditions, cost and efficiency of operation. This course will include one 3 hour period in the laboratory, making different connections on motors and generators, running machines and making simple tests of them.

Second semester, junior year. 3 units.

3. Electrical Machinery.

MR. SNOW

A study of the fundamental laws of the electromagnetic and electrostatic circuits. Algebraic and geometric treatment of electrical problems, in such a manner that an analysis of the structural and performance characteristics of electrical machinery may be easily followed.

2 hrs., first semester, senior year. 2 units.

4. Electric Traction.**MR. SNOW**

A study of the practical application E. E. 3 to generators, motors, transformers, etc. Electric railways are studied during the second part of the semester, including the railways, generators, rotary-convertisers, the different types of motors as applied to the work, a comparison of the direct and alternating current systems in electric railroad work.

2 hrs., second semester, senior year. 2 units.

5, 6. Electrical Engineering Laboratory.**MR. SNOW**

A study of the operation and characteristics of commercial machines, making complete tests of generators, motors both direct and alternating current, transformers, synchronous converter, etc. The object being to have the student become familiar with the actual operation of the machines, the common causes of trouble and their remedy.

Two 3-hr. periods, each semester, senior year. 2 units.

7. Design of Electrical Machinery and Apparatus.**MR. SNOW**

Paralleling E. E. 3. A study of the effect of design on the characteristics, cost of operation and performance of electrical machinery and apparatus. Practical calculations for the design of lifting magnets, finding and plotting the characteristics and predetermination of the operation of generators, motors, transformers and transmission lines.

Two 3-hr. periods, first semester, senior year. 2 units.

8. Electric Power Station Design.**MR. SNOW**

The selection and arrangement of electric power station equipment, wiring diagrams and switch-board connections. Transmission line design, and calculations of cost of operation, estimated cost of power delivered, power rates, etc. Two 3-hr. periods and one lecture, second semester, senior year. 3 units.

9. Alternating and Direct Current Machinery.**MR. SNOW**

A general course in the study of electrical engineering, covering electric lighting, transmission and distribution, and the construction

and operation of alternating and direct current generators and motors. Intended for non-electrical engineering students.

2 hrs. and one 3-hr. period, first or second semester. W Th, 10:20-11:15; Th, 1:00-3:45. 3 units.

10. Seminar. PROFESSOR HENLEY OR MR. SNOW

Discussion of various subjects which arise in connection with work, and review of current engineering literature.

1 hr., second semester. Th evening. 1 unit.

ENGLISH

PROFESSOR BATES, ASSISTANT PROFESSOR PERRY, MISS LUTRELL

The purpose of the literary courses outlined below is to give a general knowledge of English literature from its beginnings to the present time, chief stress being laid upon the study of representative authors, but with broader literary movements constantly in mind. The courses in composition aim to develop accurate thought and clear, vigorous expression; opportunity for work in advanced composition is afforded in connection with the courses in literature.

1. Composition. ASSISTANT PROFESSOR PERRY

Exposition; lectures and the study of Perry's *Exposition*; daily and weekly themes. Prescribed for all freshmen.

3 hrs., first semester. 3 units.

2. Composition. ASSISTANT PROFESSOR PERRY

Argumentation; study of Perry's *Argumentation*, class debates, impromptu speeches, and several written arguments. Prescribed for all freshmen.

3 hrs., second semester. 3 units.

3, 4. History of English Literature. PROFESSOR BATES

An outline of English Literature from its beginnings down to the present time. Moody and Lovett's *History of English Literature*

used as a text-book. Assigned readings from numerous authors. This course is preliminary to all other courses in English literature.

2 hrs., both semesters. 2 units, each semester.

5. 6. Elizabethan Drama.

PROFESSOR BATES

Attention is given first to the development of the Elizabethan drama from the Miracle Plays, Moralities and Interludes; the Senecan influence is studied, and the work of Llyl, Greene, Peele, Kyd, and Marlowe briefly considered; then the bulk of the year is given to a close detailed study of the leading plays of Shakespeare, followed by a cursory treatment of the post-Shakespearian drama, at least one play being read from each of the following writers: Jonson, Beaumont and Fletcher, Heywood, Webster, Middleton, Massinger and Ford. Lectures and discussions and a thesis of not less than 2,000 words.

3 hrs., both semesters. 3 units, each semester.

7. Nineteenth Century Literature. The Romantic Period.

PROFESSOR BATES

Lectures on the historical development of the romantic spirit and study of its manifestation in the poetry of Wordsworth, Coleridge, Scott, Byron, Shelley, and Keats, the essays of Lamb, Hazlitt, De Quincey, and Emerson, the fiction of Scott, Hawthorne, Poe, Charlotte Bronte and Emily Bronte.

5 hrs., first semester. 5 units.

8. Nineteenth Century Literature. The Victorian Period.

PROFESSOR BATES

Lectures on the change of spirit in the Victorian era; study of the work of the typical Victorians: Tennyson, Macauley, Dickens, Thackeray, and Eliot; study of the various forms of revolt in Arnold, Brown-

ing, Rossetti, Swinburne, Morris, Carlyle, Ruskin, Meredith, Hardy, and Stevenson.

5 hrs., second semester. 5 units.

9, 10. Principles of Literary Criticism.

PROFESSOR BATES

Through a historical study of the chief theories of literary criticism this course aims to aid the student in forming satisfactory principles of judgment for himself. In the first semester the following authors are studied: Plato, Aristotle, Sidney, Dryden, Addison, Pope, Johnson, and Burke. The second semester is devoted to writers of the nineteenth century, especially Wordsworth, Coleridge, Shelley, Hazlitt, Poe, Arnold, Pater, and various contemporary critics. Primarily for seniors.

2 hrs., both semesters. 2 units each semester.

11, 12. Methods of Teaching English.

MISS PERRY

This course is intended for students preparing to teach English in secondary schools. It will include: methods of teaching grammar, rhetoric, composition, literature; discussion of the college entrance requirements in English; the blocking out of courses, and the planning and presenting of single lessons.

3 hrs., both semesters. 3 units, each semester.

13, 14. Narration.

ASSISTANT PROFESSOR PERRY

An advanced course in which emphasis is placed on the writing of short stories. The course will afford opportunity for the consideration of the problems of the short story writer; the discovery, through analysis of specimen stories, of helpful principles and devices, and experimentation in their application in short story writing. Frequent short themes and monthly long ones will be required. Open to college students who have successfully completed English 1 and 2.

2 hrs., both semesters. 3 units, each semester. To alternate with English 11, 12.

15, 16. Contemporary Literature.

PROFESSOR BATES

The aim of this course is to afford such a study of British and American literature in the last quarter-century as will enable the student to form a clear estimate of present-day tendencies. It covers the decadent and symbolic schools of British poetry, the Irish movement, contemporary American poetry, the romantic and realistic schools of fiction, and the revival of the drama, with especial reference to the influence of Ibsen. Readings assigned in the poetry of Francis Thompson, Dowson, Symons, Henley, Yeats, and Hovey; in the fiction of Kipling, Hewlett, Bennett, and Herrick; in the dramas of Ibsen, Pinero, Jones, Shaw, Wilde, Phillips, and Synge. Lectures, discussions and quizzes.

2 hrs., both semesters. 2 units, each semester.

17, 18. Chaucer.

MISS LUTRELL

In this course a large part of the *Canterbury Tales* is read, the *Prologue to the Legende of Gode Wommen*, and some of the minor poems. The course is purely literary and a knowledge of Anglo-Saxon is not required.

3 hrs., both semesters. 3 units, each semester.

FRENCH

PROFESSOR TURRELL

1, 2. Elementary French.

First semester: Fraser and Squair, *French Grammar*, (Part I), Aldrich and Foster, *French Reader*. Second semester: Reading of Daudet, *La Belle Nivernaise*, Labiche and Martin, *La Poudre aux Yeux*, Halevy, *L'Abbé Constantin*. Composition and dictation, with drill on the irregular verbs.

5 hrs., both semesters. 4 units, each semester.

3, 4. Advanced French.

PROFESSOR TURRELL

First semester: Fraser and Squair, *French Grammar* (Part II), Merimée, *Colomba* or *Carmen*, Lamartine, *Graziella*, Sand, *La Mare au Diable* or *La Petite Fadette*. Second semester: Selected reading: including Canfield, *French Lyrics*, Victor Hugo, *Les Misérables* (abridged).

5 hrs., both semesters. 4 units, each semester.

5. French Literature to the Nineteenth Century.

PROFESSOR TURRELL

The classical French dramatists. Reading of plays of Corneille, Racine and Moliere. Lectures on the eighteenth century. Voltaire, Rousseau, Diderot, etc. Beaumarchais, *Le Barbier de Séville*. Library readings.

3 hrs., first semester. 3 units.

6. French Literature in the Nineteenth Century.

PROFESSOR TURRELL

Particular study of the drama. The Romanticists, Victor Hugo, Musset, Scribe, Augier, etc. Recent literary movements in France. Pailleron, Dumas, Rostand, Zola, Sardou, Hervieu, Maeterlinck, etc.

3 hrs., second semester. 3 units.

7, 8. Advanced Composition.

PROFESSOR TURRELL

Vreeland and Koren, *French Syntax and Composition*, Korn, *French Daily Life*, etc. Original essays and reports in French.

2 hrs., both semesters. 2 units, each semester.

Courses 5, 6, 7, 8 may be taken together or separately, but must be preceded by courses 1, 2, 3, 4.

GEOLOGY

PROFESSOR TOLMAN AND ASSISTANT

The earlier courses in geology are constructed not only to introduce the student to general and applied geology, but with special reference to the development of the observational faculties, and training in in-

ductive and deductive reasoning so that the student may discover for himself the causes for each phenomenon observed. The more advanced courses are technical and cover the essentials of geology for a mining engineer. The courses in geological mapping allow the student to take advantage of the opportunities at hand for field work, and include reconnaissance and detailed field mapping and underground geological mapping. Special field work can be undertaken by advanced students under the direction of the department.

1, 2. General Geology.

PROFESSOR TOLMAN

Geological processes, their causes and effects. The atmosphere, surface and underground water, the ocean and the ice and snow as geological agents. Earth movements; mountain and continent building; vulcanism. Rocks, their origin and alterations. Historical geology, reviewing the physical history of the earth and correlated life progress. Summary of the general principles of ore deposits.

The laboratory work covers the reading and interpretation of topographical and geological maps, the fundamentals of geological mapping, structural problems, and stereogrammatic and graphic methods for the solution of problems in faulting. Classification and laboratory study of rocks. Short field trips are taken in the second semester. Open to students who have taken Mineralogy 1.

3 hrs., and one laboratory period, both semesters. 4 units, each semester.

3. Economic Geology—Non-Metallic Products. PROFESSOR TOLMAN

Statistics, production, utilization, value, occurrence, genesis and methods of investigation of iron and manganese and the non-metallic products, viz.: coal, gas, bitumen, etc.; building stones, clays, cement materials, sands, etc.; borax, phosphates, fluorspar, gypsum, graphite, mica, asbestos, mineral paints, etc.; salines, mineral waters, artesian flows, and investigation of underground water flow, etc.; precious stones.

3 hrs., first semester. 3 units.

4. Economic Geology—Metallic Products. PROFESSOR TOLMAN

Detailed study of ore deposits. Prerequisite, Geology 1, 2.

3 hrs., second semester. 3 units.

5, 6. Field Geology. PROFESSOR TOLMAN AND ASSISTANT

Construction of maps and sections. United States Geological Survey methods of geological mapping. Geological mine mapping and stereography. Two detailed geological maps are required of each student, one of a portion of the Tucson mountains (lava flows) and one of a district in the Rincon mountains (faulted and folded sedimentary rocks), a sketch reconnaissance map, and a geological map of mine workings. Open to students who have taken or are taking Geology 3, 4 and Mineralogy 5, 6.

Lectures 2 hrs. a week during October. First field trip October 27-November 11. Office work and report must be finished by the end of the semester. Second field trip March 1 to March 16, 1912. Office work and report due May 20. A third short trip of three days for the underground mapping of an ore body may be required at the discretion of the instructor. 4 units, each semester.

7. Type Fossils. Omitted 1912-13.

Identification of the type fossils, especially the Paleozoic.

2 hrs., first semester. 2 units.

Graduate Courses.

9, 10. Advanced Ore Deposits. Omitted 1912-13.

The study of the literature of special ore deposits or special problems in ore deposition, with microscopic work.

11, 12. Advanced Field Work. Omitted 1912-13.

The detailed study and mapping of a selected area, or of a selected ore deposit.

GERMAN**PROFESSOR TURRELL AND ASSISTANT****1, 2. Elementary German.**

First semester: Paul V. Bacon, *German Grammar*. Second semester: Reading of Storm, *Immensee*, Gerstacker, *Germelshausen*. Conversation based on Paul V. Bacon, *Im Vaterland*. Grammar completed.

5 hrs., both semesters. 4 units, each semester.

3, 4. Advanced German.

First semester: Pope, *German Composition*, with review of Syntax. Reading of Meyer-Foerster, *Karl Heinrich*, Heine, poems and *Die Harzreise*. Second semester: Composition continued. Lessing, *Minna von Barnhelm*, Schiller, *William Tell*, etc.

5 units, both semesters. 4 units, each semester.

5, 6. Lessing, Schiller, and Goethe.

PROFESSOR TURRELL

First semester: Reading and interpretation of Lessing, *Emilia Galotti*, *Nathan der Weise*, Schiller, *Maria Stuart*, *Wallenstein*. Accompanied by a brief outline of German literature to the nineteenth century. Second semester: Goethe, *Hermann und Dorothea*, *Egmont*, *Die Italienische Reise*, *Faust*, Part I.

3 hrs., both semesters. 3 units, each semester.

7, 8. German Literature in the Nineteenth Century.

PROFESSOR TURRELL

First semester: The Romanticists and their successors. Class reading of Kleist, *Der Prinz von Homburg*, Grillparzer, *Der Traum ein Leben*, *Die Ahnfrau*, etc. Second semester: the rise of Naturalism and Symbolism. Wildenbruch, *Harold*, Fulda, *Der Talisman*, Sudermann, *Johannes*, Hauptmann, *Die versunkene Glocke*. Lectures and library readings.

2 hrs., both semesters. 2 units, each semester.

Note.—Courses 5, 6, 7, 8 may be taken together or separately, but must be preceded by Courses 1, 2, 3, 4.

GREEK

MRS. NEWSOM

1, 2. Beginner's Course.

MRS. NEWSOM

The work done is represented by White, *First Greek Book*; Goodwin, *Greek Grammar*; and Xenophon, *Anabasis* (first four books).

4 hrs., both semesters. 4 units, each semester.

3, 4. Homer and Plato.

MRS. NEWSOM

Homer, *Iliad* (first four books); Plato, *Apology* and *Crito*; and selections from Lysias.

4 hrs., both semesters. 4 units, each semester.

HISTORY

PRESIDENT WILDE, PROFESSOR CHANDLER

In the work in history emphasis is placed on the social and political development, the relation of cause and effect, and the unity of history. The laboratory method is used whenever possible and individual work insisted on.

*1, 2. Expansion of the American People. PROFESSOR CHANDLER

A study of the political, social and economic development and expansion of the American people from the earliest settlement on the Atlantic seaboard down to the most recent political activities in the far West. The following subjects are given special attention: the transplanting of European peoples and institutions, and the adaptation of them to American conditions; the industrial evolution in the United States; the early western movement; the public domain; the development of American democracy; the great social and economic changes accompanying and following the civil war; the settlement of the far West. During the second semester considerable time will be given to the history of the Southwest and the study of its peculiar problems. Open to all college students.

3 hrs., both semesters. 6 units.

3, 4. Mediaeval History.

PRESIDENT WILDE

A study of European history from the fall of the Roman empire to the close of the Protestant Reformation. A brief survey of the period extending to the French Revolution will connect the student with that course. The rise of institutions; the political, social, and economic life of the time; the influence of the church; the development of the modern state. The course gives a foundation for more intensive studies in history and provides a historical basis for the study of economics or other sciences.

3 hrs., both semesters. Hours to be announced. 6 units.

*Offered in 1911 and alternate years.

*5. The French Revolution and the Napoleonic Period.

PROFESSOR CHANDLER

The causes, events and results of the French Revolution, and the spread of reform under Napoleon. The study of the revolution will be prefaced by a review of the state of European civilization in the middle of the eighteenth century and the influence of the French and English schools of literature, philosophy and economics as factors in the political and economic revolutions. Open to all college students.

3 hrs., first semester. 3 units.

*6. European History Since the Congress of Vienna.

PROFESSOR CHANDLER

A study of the liberal and reform movements, social, political, economic and intellectual, up to the present time; the evolution of constitutional government; the various movements towards national unity; the Franco-Prussian war; and the rise of Germany to a commanding position in world commerce and politics; English reform bills of 1832 and 1867, and other political, religious and social-industrial reforms. Open to all college students.

3 hrs., second semester. 3 units.

7, 8. Constitutional History of the United States.

PROFESSOR CHANDLER

A detailed study of the formation of the Union and of the political and constitutional history of the United States, based on letters and speeches of American statesmen, public documents and special histories.

3 hrs., both semesters. 6 units.

LATIN

MRS. NEWSOM

The courses below are open to students who have completed the first three years of Latin in the sub-collegiate department, or an equivalent. Constant thorough drills are given in technical grammar and prose composition. In reading, the matter is subjected to gram-

*Given in 1912-1913 and offered in alternate years.

matical, metrical, rhetorical and historical explanation. The study of the text is made the means of mental discipline, of developing the faculties of observation and critical judgment, and of acquiring habits of thoroughness and accuracy.

1, 2. Virgil, Livy, and Cicero.

MRS. NEWSOM

Livy, Selections; Cicero, *de Senectute, de Amicitia*; selections from Cicero's Letters. Exercise in prose composition.

4 hrs., both semesters. 4 units, each semester.

3, 4. Tacitus and Horace.

MRS. NEWSOM

Tacitus, *Germania* and *Agricola*, Selections from Histories; Horace, *Odes*.

3 hrs., both semesters. 3 units, each semester.

MATHEMATICS

PROFESSOR GRIMES, ASSISTANT PROFESSOR MEDCRAFT

1a. Algebra.

PROFESSOR GRIMES

An introduction to College Algebra. Prescribed for all B. S. courses.

3 hrs., first semester. 3 units.

1b. Trigonometry.

ASSISTANT PROFESSOR MEDCRAFT

Fundamental formulas of the plane trigonometry with applications to surveying. Prescribed for all B. S. courses.

2 hrs., first semester. 2 units.

Students having had trigonometry may obtain college credit for the subject upon passing a satisfactory examination, provided such credit has not been used for entrance. In 1912-13 courses 1a and 1b will be thrown together into one consecutive course. 5 hrs., first semester.

2. Analytical Geometry.

PROFESSOR GRIMES

The fundamental methods of plane and solid analytical geometry. Prescribed for all B. S. courses.

4 hrs. and a 2-hr. laboratory period, second semester. 5 units.

2a. Advanced Algebra. PROFESSOR GRIMES

Continuation of Course 1a. Prerequisites: Mathematics 1a, 1b.

2 hrs., second semester. 2 units.

2b. Spherical Trigonometry. ASSISTANT PROFESSOR MEDCRAFT

Fundamental formulas and principles of the spherical trigonometry with applications to astronomy. Prerequisite: Mathematics 1b.

2 hrs., first semester. 2 units.

3. Differential Calculus. PROFESSOR GRIMES

The fundamental principles and formulae of the differential calculus, with their applications. Prescribed for sophomores in engineering courses.

4 hrs., first semester. 4 units.

4. Integral Calculus. PROFESSOR GRIMES

The fundamental principles and formulae of the integral calculus, with their applications, including the use of tables of integrals. Prerequisite: Mathematics 3.

4 hrs., second semester. 4 units.

4a. Advanced Calculus. PROFESSOR GRIMES

A supplementary course to Mathematics 4, giving especial attention to special methods of integration, and to the applications of the integral calculus to physics, mechanics, and other allied subjects.

2 hrs., second semester. 2 units.

5, 6. Analytical Mechanics. PROFESSOR GRIMES

The mathematical treatment of the fundamental principles of dynamics, statics. Prerequisites: Mathematics 4 and Physics 1, 2. Prescribed for all engineering courses.

4 hrs. and a 2-hr. laboratory period, first semester. 4 hrs., second semester. 5 units, first semester; 4 units, second semester.

5a. Differential Equations. PROFESSOR GRIMES

A course in elementary differential equations with applications to physics, astronomy and mechanics.

2 hrs., first semester. 2 units.

MECHANIC ARTS

PROFESSOR HENLEY, MR. SNOW

The courses in Mechanic Arts comprise the elements of shop work and drawing. The work consists of lectures, recitations and drawing, tool and machine work. The courses are designed with special regard for the needs of the students in engineering, an effort being made to familiarize the student with the ordinary methods in shop work, a knowledge of which is valuable to every engineer, rather than to develop the skill of the mechanic.

1. Mechanical Drawing.

PROFESSOR HENLEY

Elements of mechanical drawing, including lettering, tracing, and blue printing. The subject is treated in a purely mechanical way, the object being to enable the student to learn to make and read ordinary working drawings, and to give him some knowledge of ordinary drafting room practice.

2 3-hr. laboratory periods. One section each semester. 2 units.

2. Descriptive Geometry.

PROFESSOR HENLEY

Elements of descriptive geometry, including problems in warped surfaces and intersection of solids.

1 lecture and 2 3-hr. laboratory periods. One section each semester. 3 units.

3. Wood Shop.

PROFESSOR HENLEY

Bench and machine work; elements of pattern and foundry work.

2 3-hr. periods, with occasional lectures. One section each semester. 2 units.

4. Forge Shop.

PROFESSOR HENLEY

Forge work in iron and steel; tempering, case-hardening and annealing. A study of those characteristics of iron and steel which affect their working in the shop.

2 3-hr. periods, with occasional lectures. One section each semester. 2 units.

5, 6. Machine Shop.

PROFESSOR HENLEY

This course includes the elements of machine shop practice, and the

erection and care of machinery. The student is given work on the drill press, shaper, lathe, and planer, as well as at the bench, and on the erecting floor. Only the ordinary classes of work are taken up, the object being to make it as much as possible, a general engineering course. Open to students who have had courses 1, 3, 4 or an equivalent.

2, 3, 4 or 5 3-hr. periods, both semesters. 2, 3, 4 or 5 units, each semester.

8. Carpentry. Omitted 1912-13. MR. SNOW

A course in wood work, including framing, joining, care of tools, etc.

2 3-hr. periods, second semester. 2 units.

9. Forge and Metal Work. Omitted 1912-13. MR. SNOW

Forge work in iron and steel, pipe work, drill press, and care of small machinery.

2 3-hr. periods, first semester. 2 units.

MECHANICAL ENGINEERING

PROFESSOR HENLEY AND MR. SNOW

The work in Mechanical Engineering deals primarily with the design, construction or operation of machinery. The course includes a study of mathematics and of such sciences as are of value to all engineers, together with a certain amount of work in the other engineering departments. An effort is made to harmonize the work as much as possible with the actual conditions in practice.

1, 2. Mechanisms and Elements of Machine Design.

PROFESSOR HENLEY

Theory and design of linkages, gears, cams, screws, and other machine elements.

2 3-hr. periods, both semesters. 2 units, each semester.

3. Heat Engines.

PROFESSOR HENLEY

Principles of thermodynamics as applied to steam and internal combustion engines. Testing and operation, steam and gas engines, boilers, etc.

2 hrs. and 1 3-hr. laboratory period, first semester. 3 units.

4. Pumping Machinery. PROFESSOR HENLEY

A study of the various types of pumps and compressors, and their efficiencies under different conditions.

2 hrs. and 1 3-hr. laboratory period, second semester. 3 units.

5, 6. Machine Design. PROFESSOR HENLEY

Design, largely empirical, of various tools or machine parts.

2 3-hr. drafting periods, both semesters. 2 units, each semester.

7, 8. Mechanical Laboratory. PROFESSOR HENLEY

Testing of different types of engines, boilers, pumps, injectors and other machinery. Inspection of power plants and machinery installations.

2 3-hr. laboratory periods and 1 3-hr. computation period, both semesters. 3 units, each semester.

9, 10. Engine Design. PROFESSOR HENLEY

Design of the main features of a steam or gas engine, pump or compressor, with the completion of as much of the working details as time permits.

2 3-hr. drafting periods, both semesters. 2 units, each semester.

12. Power Plants. PROFESSOR HENLEY

A study of the economic design and operation of power and pumping plants. Problems involving the selection of machinery to perform a given duty with a probable minimum expense.

2 hrs., second semester. 2 units.

14. Small Power Plants and Pumping Machinery.

PROFESSOR HENLEY AND MR. SNOW

An abridged course in small machinery installations, dealing with the problems met with in ordinary small pumping plants. This course is designed for students in agriculture, and is made as non-technical as possible.

2 hrs. and 1 3-hr. elective laboratory period, second semester. 2 or 3 units.

16. Seminar. PROFESSOR HENLEY OR MR. SNOW

Discussion of various subjects which arise in connection with the work and the review of current engineering literature.

1 hr., second semester. 1 unit.

METALLURGY

PROFESSOR GOODRICH

1. Introduction to Metallurgy. PROFESSOR GOODRICH

Physical properties of metals, alloys, thermal treatment of metals, thermal measurements, fuel, refractory materials, metallurgical processes, furnaces, thermo-chemistry, metallurgy of iron and steel.

Lectures, 1 hr., first semester. 1 unit.

2. Fire Assaying. PROFESSOR GOODRICH

Fire assay for gold, silver and lead. Bullion assays. Prerequisite, Chemistry 3, 4.

Three 3-hr. laboratory periods, second semester. (March, April, May.) 2 units.

3. Metallurgy of Gold and Silver. PROFESSOR GOODRICH

Stamp milling, chlorination, tube-milling, and filtering, cyaniding, pan-amalgamation; Patio, and Tina processes; hyposulphite leaching practice, etc. Lectures. Prerequisite, Metallurgy 1, 2, 7. 3 hrs., first semester. 3 units.

4. Metallurgy of Lead and Copper. PROFESSOR GOODRICH

Sampling, receiving, purchasing, roasting; blast furnace methods, reverberatory furnace methods; pyritic smelting, converting, desilveration of base bullion, electrolytic refining, hydro-metallurgy of copper, etc. Lectures. Prerequisites, Metallurgy 1, 2, 7.

4 hrs., second semester. 4 units.

5a. Metallurgical Laboratory. PROFESSOR GOODRICH

Amalgamation, cyaniding, chlorination, hyposulphite lixiviation, etc., tests, together with mill work. This course runs parallel with Metallurgy 3. Lectures.

1 3-hr. laboratory period, first semester. 1 unit.

5b. Metallurgical Laboratory.

Sampling, concentration, mill work. This course runs parallel with Metallurgy 7. Lectures.

1 3-hr. laboratory period, first semester. 1 unit.

6. Metallurgical Laboratory Thesis Work. PROFESSOR GOODRICH

The student will take up original problems in the treatment of ores, making a series of experiments to determine the best method of treatment. The equipment now is as complete as some of the best commercial ore testing plants, and new machinery is constantly being added.

2 3-hr. laboratory periods, second semester. Time to be arranged.
2 units.

7. Ore Dressing. PROFESSOR GOODRICH

Breaking, crushing, separating, concentrating, sampling; mill processes and management. Lectures and recitations. Prerequisite, Metallurgy 2.

3 hrs., first semester. 3 units.

8. Metallurgy of Rare Metals. PROFESSOR GOODRICH

Metallurgy of zinc, cadmium, nickel, mercury, bismuth, tin, antimony, cobalt, platinum, tungsten, molybdenum. Lectures. Prerequisites, Metallurgy 1, 2 and 3.

2 hrs., second semester. 2 units.

9. Excursions. PROFESSOR GOODRICH

On the completion of the various subjects, trips will be taken to suitable plants, in order to study practically the metallurgical operations. The student thus is enabled to reap the advantage of our location—central in a great metallurgical field.

10. Concentrator and Smelter Design. PROFESSOR GOODRICH

This course is a practical metallurgical problem, such as may confront the student on entering practical work. The student may design the plant to suit the ore tested in Met. 6 Course.

2 hrs. and one 3-hr. drafting periods, second semester. 3 units.

MINERALOGY
PROFESSOR GUILD

The main object of the courses in mineralogy is to familiarize the student with facts and methods that will enable him to determine the character of an ore or mineral by observation of its physical properties and by the performance of a few simple tests with the blow-pipe, since in the field and mine recourse can not usually be had to a well equipped chemical laboratory.

1. Determinative Mineralogy and Blow-Pipe Analysis.

Laboratory work with occasional recitations. Text-book: Brush and Penfield, *Determinative Mineralogy and Blow-Pipe Analysis*. Prerequisite, Chemistry 2.

Two 3-hr. laboratory periods, first semester. 2 units.

3. Elementary Crystallography.

Two lectures or recitations per week. Prerequisite, Physics 2. 2 units.

4. Descriptive Mineralogy.

Lectures and recitations on the mode of occurrence, uses and classification of minerals. The study of a large number of hand specimens of minerals. Text-book: Dana, *A Text-book of Mineralogy*. Prerequisites, Geology 1, Mineralogy 1 and 3.

3 lectures, 1 laboratory period, second semester. 4 units.

5. Optical Mineralogy.

With microscopic study of the rock-forming minerals. Prerequisites: Geology 2, and Mineralogy 4.

2 hrs., or an equivalent, first semester. 2 units.

6. Petrography.

The preparation of thin sections of rocks for microscopic study, and the study of a type selection of rocks. Prerequisite: Mineralogy 5.

2 hrs., or an equivalent, second semester. 2 units.

7. Crystallography.

The measurement, projection and drawing of crystals. Prerequisite: Mineralogy 3.

Either semester. 2 or 4 units.

MINING ENGINEERING

PROFESSOR TOLMAN AND ASSISTANT

In this course attention is largely directed to the operations and economics of mining, and the laboratory and drafting work is so arranged that the student will have plans and designs which will be of value in the practice of the profession.

1, 2. General Mining.

Study of explosives and blasting, air compressors and air compression, air drills, drilling and boring, mine timbering, ventilation, transportation and hoisting of ore, mining machinery and its installation, surface improvements around mines.

2 hrs., both semesters; prerequisite: Geol. 1, 2, 9. 2 units, each semester.

3, 4. Laboratory in Mining.

The study of designing of timbering, and mining construction of all kinds, ore bins, heat-frames head-gear, dumping devices, etc.

One 3-hr. laboratory period, both semesters. 1 unit, each semester.

5, 6. Lectures on Mining Methods and the Economics of Mining.

PROFESSOR TOLMAN

5. The detailed analysis of placer, open cut and underground mining methods.

1 hr., first semester. 1 unit.

6. Economics of mining, and a summary of mining law.

1 hr., second semester; prerequisite: Geol. 1, 2, 4. 1 unit.

Note.—All students in Mining Engineering are required to put in a minimum of one hour a week for each unit taken in the Mining Engineering courses, in the preparation of a card catalogue and summary of current technical literature on mining. These cards will be examined every week by the department.

7. Practical Mining. Before entering upon the work of the senior year, all students who are candidates for the degree of B. S., in Mining Engineering, must have spent at least four weeks in practical underground mining. The fulfillment of this requirement must be evidenced by the certificate of the mine superintendent or foreman, and by notes and sketches of the processes observed, to be presented to the faculty of the School of Mines, and discussed with them.

8. Summer School of Mine and Topographical Surveying.

A 4-weeks course in the field during which detailed mine surveys will be carried out. The course will be given during the month of June, and in the northern part of the Territory where the high elevation makes the summer climate delightful. Required of all students taking the degree of B. S. in Mining Engineering, after June, 1912, unless the equivalent of actual underground surveying is offered. This course should be taken preferably at the close of the sophomore year. Given in alternate years. Omitted in the summer of 1912. Open to students who have taken Civil Engineering 1, 2.

9. Field Excursions.

In connection with the courses in mining engineering, trips will be made to mining districts in Arizona and Sonora, usually one or two weeks in March or April. These trips are required of all candidates for the degree of B. S. in Mining Engineering.

The purpose of these trips is to afford the student an opportunity for close study and inspection of mining and metallurgical plants, and of rock formations and of minerals of commercial value. The students are accompanied by members of the faculty, and every effort is made to make the trips of the greatest practical value. The visits are carefully scheduled and notes, with sketches, measurements and photographs are taken, and elaborated into comprehensive reports by each student after the return.

During April, 1910, the mining districts and the reduction plants of Globe, Miami, and Ray were visited in this way. It is expected to repeat the trip in April, 1912, when students will have opportunity to examine much reconstruction now in operation.

PHILOSOPHY AND EDUCATION

MRS. STANLEY

- *1, 2. History of Philosophy. ASSISTANT PROFESSOR STANLEY

A study of the basal concepts and fundamental problems of philosophical thought as developed historically. Lectures, recitations and assigned reading. Text-books: Schwegler's *History of Philosophy*; Calkins, *The Persistent Problems of Philosophy*. Open to Juniors and Seniors.

3 hrs., both semesters. 3 units, each semester.

3. Psychology. ASSISTANT PROFESSOR STANLEY

A special consideration of the subject as applied to teaching. Lectures, recitations and collateral reading. To be taken in the Sophomore year. Text: Angell's *Psychology*.

3 hrs., first semester. 3 units.

- *4. Pedagogy. ASSISTANT PROFESSOR STANLEY

An account of educational evolution, both as a culture fact in the history of civilization and as a foundation for professional work; lectures, giving a brief but comprehensive outline of school systems, a special study of leading educators such as Comenius, Pestalozzi, Froebel, Mann, and others. Arrangements have been made with the Tucson city schools to provide practice work for this class. Open to students who have taken Philosophy 1.

2 hrs., both semesters. 2 units, each semester.

- *5. Logic. ASSISTANT PROFESSOR STANLEY

Text-book, Jevons' *Logic*; reading from Mill, Hamilton, Thompson and others. Open to Juniors and Seniors.

4 hrs., first semester. M W Th F, 9:25-10:20. 4 units.

6. Introduction to Ethics. ASSISTANT PROFESSOR STANLEY

Theoretical and practical ethics; view of the historical development of the science; origin and development of the moral conscious-

*Omitted 1912-1913.

ness; application of the principles of ethics to the problems of life. Lectures, discussions and assigned readings. Open to Juniors and Seniors.

3 hrs., second semester. 3 units.

7, 8. Philosophical Problems in Great Books. **MRS. STANLEY**

A comparative study of interpretations of life as revealed in masterpieces of the world's literature.

This course is designed to meet the needs of students who cannot afford the time for advanced English or philosophy, as well as to supplement the course now offered in those departments. The programme as planned will include ten great books, viz.: *The Antigone of Sophocles*; *The Apology of Socrates*; *The Book of Job*; Dante's *Divine Comedy*; *Les Misérables*; *Faust*; Tolstoi's *Anna Karenina*; Ibsen's *Peer Gynt*. Lectures and interpretative readings. Open to Juniors and Seniors.

Hours and credits to be announced.

PHYSICAL TRAINING

MR. KLEEBERGER

The department of physical training has general direction of the gymnastic and athletic activities of the University. The department aims to give the students such exercises, games, and sports as will best create and maintain a vigorous physical health, and to this end it strives to reach as many persons as possible, especially the weak and undeveloped, and to give to each one exercise that will at once benefit, interest, and stimulate him. Physical training is prescribed for all freshmen and sophomores from October 1st to May 15th. With the approval of the director of the gymnasium, students may substitute some form of regular athletic work for the course in the gymnasium for specified periods.

A. Physical Examination for Men.

MR. KLEEBERGER

The examination includes about thirty measurements of the body, tests of strength, and examination of the heart, lungs, and other vital organs, together with inspection for marks of vaccination and physical inequalities. Prescribed for all freshmen and sophomores at the be-

ginning of the year or on entrance into these classes. A second examination is optional with the instructor, while a rigid and complete special examination by the University physician may be ordered at any time without expense to the student.

1, 2. Gymnastics and Hygiene for Men.

Setting-up exercises, calisthenic drills, indoor games, and simple apparatus work. Lectures on the physiology of exercise, personal hygiene and corrective exercises. Required of all freshmen unless excused on recommendation of a physician.

2 half-hour periods, both semesters. 1-2 unit.

3, 4. Advanced Gymnastics.

A continuation of the work of the first year; the use of apparatus, parallel bars, horizontal bar, horses, rings, out-door runs, etc. When possible the class will be divided into graded sections for special work on the apparatus. Required of all sophomores unexcused by the University physician.

2 half-hour periods, both semesters. 1-2 unit.

5, 6, 7, 8. Gymnastics for Women.

The work is prescribed for young women as for men, and resembles that for men in its general scope and aim. It is, however, modified to suit the needs of the young women, emphasis being laid upon poise, carriage, grace, and development. Music is used for class drills, marching, and dancing. A gymnasium suit is necessary, consisting of a loose blouse waist, divided skirt, and the regular gymnasium shoes. The waist has a sailor collar trimmed with white braid. Four yards of double width, 54-inch dark blue serge is required. Ready-made suits may be purchased for about \$4 at the gymnasium. Required of freshmen and sophomores.

3 half-hour periods each semester. 2 units.

B. Football, Baseball, Basketball, Tennis, and Field and Track Work.

Recreative sports as a relaxation from study and as a means of development are recognized by the University in its provisions of fields, courts, etc., and by its acceptance of time devoted to such sports, with the approval of the director of the gymnasium, as satis-

faction for part of the requirements in physical training. Save for the traditional seasons fixed for these sports by climatic conditions in other regions, they might all be indulged in throughout nearly the whole academic year, as is the case with tennis. The direct control and management of these sports and the competitive games with outside teams, are vested in the Athletic Association of the University of Arizona, made up of both students and faculty, but officered by students. During the current year, contests have been held with the Agricultural College of New Mexico in football; with the Tempe Normal School in track and tennis; and with the Tucson high school in football, baseball, basketball and tennis.

PHYSICS

PROFESSOR DOUGLASS

The object of this course is to acquaint the student with the fundamental physical principles which underlie the higher courses of chemistry, mechanics and engineering. Note books are required in all courses.

1, 2. General Physics.

PROFESSOR DOUGLASS

Lectures, recitations and laboratory work. First semester: Mechanics and heat. Second semester: Electricity, wave motion, sound and light. The laboratory experiments give prominence to general electrical measurements, but include the study of wave motions and their application to the other subjects. Prerequisites: A course in elementary physics and mathematics 1.

2 hrs., and two 2-hr. periods in the laboratory, both semesters. 4 units, each semester.

3. Thermodynamics and Heat.

PROFESSOR DOUGLASS

A study of the foundation principles underlying mechanical engineering, latent and specific heats, conductivity, expansion, mechanical equivalent, high temperatures, cycles, entropy, properties of steam, etc. Prescribed for third year in mechanical engineering course.

1 hr. and two 3-hr. periods, first semester. 3 units.

4. Electrical and Optical Measurements. PROFESSOR DOUGLASS

A study of the electrical machines and instruments used in mechanical engineering, and of the optical instruments handled in mining and civil engineering courses. Prescribed for the third year in mechanical and civil engineering courses.

1 hr. and two 3-hr. periods, second semester. 4 units.

SPANISH**PROFESSOR TURRELL****1, 2. Elementary Spanish.**

First semester, Hills and Ford, *Spanish Grammar*; Turrell, *Spanish Reader*, begun. Conversation and oral work. Second semester: Grammar and reader completed; additional readings with composition and dictation.

5 hrs., both semesters. 4 units, each semester.

3, 4. Advanced Spanish.

First semester: Reading of Johnson, *Cuentos Modernos*; Alarcón, *El Capitan Veneno*. Second semester: Galdós, *Mariánela*; Valdés, *La Alegria del Capitan Ribot*, etc. Three hours each week during the first semester and two hours during the second will be given to composition, letter writing and syntax, using Umphrey, *Spanish Composition*, and Bonilla, *Spanish Daily Life*.

5 hrs., both semesters. 4 units, each semester.

5. Spanish Literature to the Nineteenth Century.**PROFESSOR TURRELL**

Lectures in Spanish on the early literature of Spain, the "Siglo de Oro," etc., with library readings. Class study of Cervantes, *Don Quijote* (Selections); Lope de Vega, *La Estrella de Sevilla*; Calderón, *La Vida es Sueño*, etc.

3 hrs., first semester. 3 units.

6. Spanish Literature in the Nineteenth Century.**PROFESSOR TURRELL**

Particular study of the drama. Reading of Moratin, *El Si de las*

Ninas; Larra, *Partir a Tiempo*; Gutiérrez, *El Trovador*; Tomayo y Baus, *Lo Positivo*; Nunez de Arce, *El Haz de Lena*; Echegaray, *El Gran Galeoto*; Galdós, *Electra*.

3 hrs., second semester. 3 units.

7. General Survey of the Literature of the Countries of Spanish America. PROFESSOR TURRELL

Class reading of Ugarte, *La Joven Literatura Hispano-americana*; Hills, *Bardos Cubanos*; Avellaneda, *Baltasar*, etc.

2 hrs., first semester. 2 units.

8. History of Mexican Literature. PROFESSOR TURRELL

Reading of works by the best authors, as included in the *Biblioteca de Autores Mexicanos*, etc.

2 hrs., second semester. 2 units.

- 9, 10. Advanced Spanish Composition and Commercial Spanish.

PROFESSOR TURRELL

A practical course in writing and speaking Spanish. Harrison, *Spanish Correspondence*; Remy, *Spanish Composition*, etc., will be used. Original essays, letters and reports in Spanish. (May be taken with courses 5, 6, but must be preceded by courses 1, 2, 3, 4.)

2 hrs., both semesters. 2 units, each semester.

ZOOLOGY

MR. BROWN

1. Invertebrate Zoology.

The development and anatomy of types of the various phyla of invertebrates. Text: Parker and Haswell, *A Manual of Zoology*.

4 units.

2 hrs. of lectures and 6 hrs. of laboratory work, first semester. M

2. Vertebrate Zoology.

A continuation of course 1.

4 units.

3. Histology of the Animal Tissues.

Instruction is given in the theory and use of the microscope, the camera lucida, the photo-micrographic camera, the use of chemicals

in the preparation of microscope slides. The course is primarily a laboratory course. 4 units.

4. Physiology.

Physiology of circulation, respiration, digestion, secretion, excretion. Laboratory work is emphasized. Experiments are made on cats, guinea pigs, rabbits, etc., each student presenting a full set of notes recording results obtained.

2 hrs. lecture, 6 hrs. laboratory. 4 units.

SHORT COURSE IN AGRICULTURE

This course is offered, first, to meet the demands of prospective homeseekers in Arizona. Second, to give the young man who feels that he can not afford the time or the means to pursue a full college course a brief introduction to the bases of successful farming, and to give him a measure of that general culture incidental to University life, and which makes so much for good citizenship. Third, to equip young men to take advantage of opportunities and to fill positions demanding more intelligence and skill than ordinary farm labor. Opportunities and positions for young men of such training are now open in Arizona and will become more frequent as the great reclamation projects being carried on are completed. As specific examples may be mentioned: First, the vast areas of desert land in Arizona that may be reclaimed by pumping, the development of which has scarcely been touched; but to make the most of such opportunities one will need more mechanical skill and more knowledge of the physical properties of soil than the average farmer possesses. Second, the University has recently had several calls for farm managers at salaries ranging up to \$150 per month, and expects such calls to increase in number. Courses in Irrigation, Engineering, Farm Management, Soil Physics, Vegetable Gardening, Orchard Management, and Farm Dairying, are especially designed to equip young men to take advantage of these opportunities and positions.

ADMISSION

Students will be admitted to the short course who have a general

knowledge of the common school branches and sufficient maturity in years to understand the value of their time and opportunity. They will be accorded the same privileges, and required to observe the same regulations, as other students registered in the University and resident upon the campus.

EQUIPMENT

The University is amply equipped with library, laboratory, and green-house facilities, while the development of a farm of 80 acres recently purchased will give opportunity for an abundance of practice in the application of the knowledge gained in the class room, library, laboratory and green-houses.

The following outline of the course of study indicates the scope of the work done. In addition to the time spent in the class room indicated below, students will be required to do a limited amount of work on the farm, for which they will be paid by the University.

SHORT COURSE IN AGRICULTURE

FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Agr. 3 (Live Stock Judging) .	3	Agr. 4, Dairying.....	3
Agr. 1 (Plant Culture).....	3	Agr. 2, Farm Crops.....	3
Agr. 15 (Poultry).....	3	Agr. 14, History of Breeds...	3
Mech. Arts 1 (Mechanical Drawing)	2	Mech. Arts 8 (Carpentry) ...	2
Mathematics or English.....	5	Mathematics or English.....	5

SECOND YEAR

Mech. Arts 9 (Forge and Metals)	2	Mech. Eng. 14, Small Power Plants and Machinery.....	2
Civ. Eng. 19 (Surveying)....	3	Civ. Eng. 20 (Irrigation)....	3
Botany I	4	Botany III	4
Agr. 5 (Market Gardening) .	3	Agr. 12 (Citrus Fruits).....	4
Agr. 9 (Soil Physics).....	4	Agr. 16 (Feeds and Feeding) .	3

For a description of these courses see pages 53 to 59.

AGRICULTURAL EXPERIMENT STATION STAFF

ARTHUR H. WILDE, Ph. D., President of the University.
ROBERT H. FORBES, M. S., Director and Chemist.
JOHN JAMES THORNBERRY, A. M., Botanist.
ALBERT E. VINSON, Ph. D., Biochemist.
WILLIAM H. ROSS, Ph. D., Assistant Chemist.
FREDERICK W. WILSON, B. S., Animal Husbandman.
G. E. P. SMITH, C. E., Irrigation Engineer.
FRANK C. KELTON, B. S., Assistant Engineer.
ROBERT W. CLOTHIER, M. S., Agriculturist.
ALEXANDER M. McOMIE, B. S., Assistant Agriculturist.
GEORGE F. FREEMAN, B. S., Plant Breeder.
DONALD F. JONES, B. S., Assistant Plant Breeder.
AUSTIN W. MORRILL, Ph. D., Entomologist.
E. DANA TROUT, Secretary.

ORGANIZATION AND WORK

The Agricultural Experiment Station is a legally constituted department of the University, whose purpose is to aid "in acquiring and diffusing * * * useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science."

With the above objects in view the organization of the station includes the departments of administration, agriculture, horticulture, animal husbandry, botany, entomology, plant breeding, chemistry, and irrigation investigations, the whole or a major portion of the time of one or more members of the station staff being devoted to each department of the station work. Provision is made for meteorological work also, though to a less degree.

Owing to the wide variation in agricultural conditions in Arizona, it has been found of advantage to distribute the work so that each department is located, so far as possible, in that region most favorable to the accomplishment of its own special results. According to this

principle, the various lines of Experiment Station work have been distributed as follows:

The Director's office and the departments of botany, plant breeding, chemistry, and irrigation investigations are maintained at Tucson in the University buildings. It has been found that from this base of operations the three great agricultural districts of the Territory—Salt River Valley, the lower Colorado, and the upper Gila—are accessible with equal convenience for field work and observations.

On the same ground—fitness of location for the work undertaken—the Experiment Station Farm has been maintained and strengthened at Phoenix. Salt River valley is intermediate in elevation, in situation, and in mean yearly temperature, between the other two important farming districts above mentioned, and for this reason the agricultural and horticultural results obtained there are capable of the most general application in the Territory at large.

On the same principle again, the date palm orchard, conducted in co-operation with the United States Department of Agriculture, is located in the alkaline district south of Tempe, where a successful demonstration of this palm as a commercial fruit producer will be of the greatest value, creating use for great areas of alkaline land in the arid southwest.

The demonstration farm near Yuma, in the fertile Colorado valley bottom, has likewise afforded a succession of object lessons to the public of that locality, as well as much needed information concerning crops, agricultural methods and markets for that rich region.

Experiments in dry-farming have been undertaken on tracts in the Sulphur Springs Valley, between Willcox and Douglas, in the neighborhood of Snowflake in Navajo County, and near Prescott, in localities typical of large areas.

The range station, also, for the study of worn-out range country with a view to its reclamation to usefulness, is conducted in a typical district near Tucson, and is operated under the auspices of the department of botany, co-operating with the United States Department of Agriculture.

The results of the Experiment Station work are made public at

frequent intervals in the bulletins and reports of the Station. These publications are made in two series: First, the longer and more technical bulletins, stating in considerable detail the investigations as they mature; and, secondly, the Timely Hints for Farmers, which are brief writings issued at the time when they will be most useful, written in plain language, and presented in popular form.

Along its several general lines of effort the Station during the eleven years ending with 1911 has issued 121 publications, exclusive of annual reports which contain much technical information of similar character. These publications may be classified as follows:

Soils, waters, alkali, and farm management, 26; climate, 2; crops, 45; weeds, insect pests and plant diseases, 16; irrigation 12; animal industry and the range, 20.

When it is remembered that for years past the mailing list has enabled us to reach from forty to fifty per cent of the farming population of the Territory, it is not surprising that the effects of Station work are now generally in evidence, more particularly in our irrigated southern valleys.

Continuing with former appropriations the Twenty-Fifth Territorial Legislature set aside \$13,100 for the use of the Experiment Station for the biennium ending in 1911. This appropriation provides for printing, for Farmers' Institutes, for dry farming experiments, for the maintenance of the date orchard at Tempe. The El Paso & Southwestern Railroad has also contributed \$5,000 for hydrographic and dry farming investigations in Sulphur Springs Valley. Supplementing the Federal funds, therefore, provision is made for the symmetrical development of this work in the Territory, both experimentally and educationally; and, prospectively, "the farmer's college" bids fair to increase in usefulness to the growing agricultural interests of the Territory.

BUREAU OF MINES AND ASSAYING

A separate department of the School of Mines under the name of "The Bureau of Mines and Assaying" has been established to receive

and work ores, and to make assays and analyses of ores, minerals, mineral waters and petroleum.

In accordance with the Act of the Legislature of the Territory, approved March, 1897, and amended in March, 1899, assays of ores and minerals are made for the prospectors and miners of Arizona and for others at fixed rates established by the law, and tabulated below. To meet the requirements of this work a special laboratory building of brick has been erected and maintained. Qualitative determinations of the nature of samples are made free.

Extreme accuracy and excellence of work are considered of more importance than pecuniary profits. All assays are made in duplicate and if not accordant are repeated. The work of the Bureau is under the personal direction of the professor of metallurgy and a paid assistant; the assays are not made by students, who receive their instruction in the regular laboratories of the University.

The money received for assaying is deposited monthly to the credit of the assay fund which is used to pay the assayer and the cost of material and apparatus.

RATES FOR ASSAYING AND CHEMICAL DETERMINATIONS

COMMON ASSAYS AND CHEMICAL DETERMINATIONS

One element only:

Gold, or silver, or copper, or lead, or iron, or insoluble.....	\$ 1.00
Zinc, or calcium, or magnesium, or sulphur, or manganese....	1.50
Silicon or chlorine	2.00

Combinations:

Gold and silver	1.00
Copper and iron, or lead and iron.....	1.50
Insoluble, copper, and lead	2.00
Insoluble, copper, and iron	2.00
Insoluble, lead, and iron	2.00
Insoluble, zinc, and iron	2.50
Insoluble, lead, copper, and iron	2.50
Gold, silver, copper, and lead	2.50
Gold, silver, copper, iron, and insoluble.....	2.50

SPECIAL CHEMICAL DETERMINATIONS

One element only:

Aluminum, or tungsten, or barium, or chromium.....	3.00
Cadmium, or tin, or arsenic, or bismuth, or antimony, or titanium, or sodium, or potassium, or uranium, or phosphorus..	4.00
Nickel, or cobalt, or molybdenum, or vanadium.....	5.00

CHEMICAL ANALYSIS

Coal and coke analysis, giving moisture, volatile combustible matter, fixed carbon and ash	5.00
The same, including determination of sulphur and phosphorus	7.50
Silicate analysis	15.00
Cement analysis (chemical)	15.00
Cement analysis (mechanical)	2.50
Cement tests for strength and soundness by the Department of Civil Engineering	5.00
Boiler water analysis	10.00

RATES FOR TESTING ORES

Stamp mill amalgamation, including sampling, assays, retorting, etc.:

For lots of one ton or thereabouts.....	\$30.00
The same, with concentration of pulp on Wilfley table.....	30.00
For lots of two tons, without concentration.....	40.00
For lots of two tons, with concentration.....	45.00

Smaller amalgamation tests, including all sampling charges, and concentration after amalgamation:

For small samples, up to five pounds.....	\$ 7.00
For small samples, five to twenty-five pounds.....	10.00
For small samples, twenty to one hundred pounds.....	15.00

In these smaller tests, the sample is ground to pass a suitable mesh, and is agitated with mercury. The mercury is panned out, retorted, and the values determined in bullion. The values in the concentrates and tailings are also determined. The number of tests necessary to determine the adaptability of any ore to treatment in cyaniding varies so greatly that no general rates can be offered.

CONSIGNMENTS, REMITTANCES, ETC.

Samples, ores, and other consignments should be shipped to the University of Arizona, Tucson, Arizona. Small quantities may best be sent by mail, at the rate of one cent per ounce; larger quantities by express or by freight. The Wells Fargo Express Company makes daily deliveries at the University.

All assays, chemical determinations and chemical analyses, except gratuitous qualitative tests mentioned elsewhere, must be paid for in advance.

Determinations will be made when the required payment arrives. Remittances should be made by postoffice money order, Wells Fargo money order, bank draft, or check on a Tucson bank, payable to Dr. A. H. Wilde, President, University of Arizona, to whom also business communications relating to matters discussed in this circular should be addressed.

PREPARATORY DEPARTMENT

FACULTY, 1911-1912

ARTHUR HERBERT WILDE, Ph. D., President.

FRANCES M. PERRY, A. M., Principal; English.

WILLIAM W. HENLEY, A. B., Shop Work and Drawing.

ANDREW ELLICOTT DOUGLASS, D. Sc., Physics.

ROBERT W. CLOTHIER, M. S., Agriculture.

CAPT. HIRAM M. POWELL, Military Science and Tactics.

WILLIAM GEORGE MEDCRAFT, A. M., Mathematics.

BEDROS TATARIAN, B. S., Chemistry.

LEVONA PAYNE NEWSOM, Ph. D., Latin and Greek.

FRANK LEWIS KLEEBERGER, B. S., Physical Training.

FREDERICK E. TALMAGE, B. L., Bookkeeping, Stenography.

IDA C. REID, Ph. M., Mathematics and History.

WILLIAM L. FOWLER, B. S., Animal Husbandry.

JOSEPHINE MACK, A. B., English.

ELIZABETH E. ROBERTS, A. B., German.

IDA W. DOUGLASS, Ph. B., Spanish and French.

By vote of the Regents of the University the first year of preparatory work will be discontinued after June, 1912, and the second year after June, 1913.

GENERAL INFORMATION

In this department the University offers the work of the last three years of high school, with the added advantages of shop work and drawing, and military drill. The general library and gymnasium are open to all students in this department.

The equipment of the scientific laboratories is available for use in this preparatory work, whenever it can be used advantageously, and makes possible strong work in elementary science. The instructors in this department are assisted by the professors of the college departments, several of whom regularly conduct preparatory classes. By reference to the course of study which follows, it will be seen

that it offers a comprehensive training for those who may not be able to pursue their studies farther, while it gives a good preparation for college.

Admission to regular standing in the preparatory course presupposes the completion of the work of the ninth grade of the public or parochial schools. Students who do not bring certificates showing the completion of this work, must take examinations to test their ability to pursue profitably the work of the first year. Arizona students who have completed the work of the eighth grade and who live in districts where the ninth year's work is not offered, will be admitted to the dormitories as regular preparatory students, but will go to the Tucson High School for most of their work.

All students entering the preparatory department will be required to take an examination in oral reading. To remedy notable deficiency in this subject, the University will require extra work in addition to other studies. In all cases in which the preparation of a student in a particular subject proves to be deficient, the University reserves the right to require the student to secure at his own expense the help of an approved coach until the deficiency is remedied.

LIVING ACCOMMODATIONS AND EXPENSES

A portion of South Hall is set apart for the use of male preparatory students; details of furnishings, living expenses, etc., are set forth in a paragraph earlier in this Register. These expenses are substantially the same for both college and preparatory students, save that laboratory fees and book bills are higher for the former. The expenses necessarily incurred during the academic year are about \$300, but of this amount nearly one-third falls due in the first month, or in the six weeks before November 1st, in the form of charges which are made but once during the year. The following are the estimated ordinary expenses for the first month:

Incidental fee	\$10.00
Dormitory fee, first payment.....	10.00
Mattress, blankets, pillows, etc., (unless brought from home) ..	15.00
Board by the month.....	18.00
Books	6.00

Shop and Drawing fee	5.00
Military uniform	16.25
<hr/>	
DORMITORIES	\$80.25

The dormitory is in charge of two resident instructors. Inspection of rooms is made in the morning and in the evening by the head of the dormitory. The hours from seven to quarter past nine in the evening are observed as study hours except on Fridays and Saturdays. Students under twenty-one years of age are required, unless relieved by the President, to obtain permission to leave the campus, or to leave the dormitory during study hours, except on Sundays from nine to twelve a. m., Wednesdays, four to seven p. m., and Fridays, four to six p. m. For damage to University property, a money penalty is imposed.

COURSE OF STUDY

The following course of study will be required of all students who fit themselves at the University for entrance to the freshman class in 1912. Such variations from it will be permitted as will adapt it to the case of students who took part of their work in other schools.

Military drill is required of all able-bodied male students throughout the course. Physical training is required of all students, unless they are excused by the President upon presenting a certificate from a physician. The young men have drill three times a week and exercise in the gymnasium twice. The young women have physical culture three times a week.

Though the subjects are for convenience grouped by years in the following schedule, the departmental method is followed. In the description of courses, the subjects are arranged by groups or departments in the consecutive order in which they are taken up and students will be required to take them in this order. Aside from this sequence the ability of each student must determine what subjects will be pursued at any given time, due regard being given to the ~~proper~~ balance of subjects. The wishes of parents will always be given careful consideration in making up the schedule of work for each student, but the final decision in the matter rests with the committee on registration, which is composed of persons who have had

long experience in secondary and collegiate teaching. Individual attention will be given to the needs of each student.

A certificate is granted to students who have completed satisfactorily the work required for entrance to the Liberal Arts courses of the University.

Students who have completed the entrance requirements of a University course are admitted to that course without examination. The entrance requirements to the various University courses are repeated below for the convenience of the Preparatory student.

Admission requirements for Bachelor of Arts or Bachelor of Science:

English	3 units*	American History and Language other than English	Civics	1 unit	
Mathematics (1½ algebra, 1 plane geometry) .2½ units		Physics, Chemistry or Bi- ology	1 unit		
		Electives	5½ units		
		Total, 15 units			

Admission requirements for Bachelor of Science in Agriculture are the same as the entrance requirements for the general B. S. degree, excepting that language, other than English, is elective.

(Admission to the short course in Agriculture is possible without previous high school work.)

Admission requirements for the Bachelor of Science in Engineering are as follows:

English	3 units	Mathematics	3 units
Language, other than English	2 units	Physics or Chemistry.....	1 unit
		Electives	6 units
Total, 15 units			

For Civil, Electrical, and Mechanical Engineering, Physics is required.

For Mining Engineering both Physics and Chemistry are required, leaving only five electives.

The following distribution of work is required, unless, in the opinion of the registration officer, there is good reason for departing from it:

*A unit represents a subject pursued for one year with five or four recitation periods a week.

FIRST YEAR

(When possible, students should pursue at home the work of the ninth grade.)

English	5 hrs.	Greek and Roman History .3 hrs.
Algebra	5 hrs.	Physical Geography.....3 hrs.
And ten or eleven hours from the following courses:		Language, not English....5 hrs. Agriculture5 hrs.

SECOND YEAR

English	5 hrs.	Biology	5 hrs.
Algebra	5 hrs.	Language, not English....5 hrs.	
And any two of the following courses:		Bookkeeping	5 hrs.

THIRD YEAR

English	5 hrs.	*Languages, other than English, each	5 hrs.
Plane Geometry.....	5 hrs.	Stenography	5 hrs.
Chemistry	5 hrs.	One of 2nd yr. electives...5 hrs.	

FOURTH YEAR

American History and Civics	5 hrs.	Solid Geometry, 2nd Sem..	5 hrs.
And any three of the following:		Physics	5 hrs.
English	5 hrs.	Languages, each	5 hrs.

OUTLINE OF STUDIES**ENGLISH**

The preparatory course in English is planned to give the student knowledge of the fundamental requirements of grammar and rhetoric, to make him acquainted with good literature, and to establish good habits in written and oral expression and in reading. The time is therefore divided between the study of composition and literature. The course covers the work mapped out by the National Conference on Uniform Entrance Requirements in English. The following description of courses will give an idea of the scope and character of the work:

*Since one language must be continued through two years to meet entrance requirements, the election of the first foreign language should not be delayed beyond the beginning of the third year.

FIRST YEAR

GRAMMAR: Scott and Buck, *A Brief English Grammar*.

COMPOSITION: The students are given constant practice in writing simple themes based on their own experience.

LITERATURE: For close study and class room discussion—Longfellow, *Hiawatha*; Scott, *Marmion*; Homer, *Odyssey*; Stevenson, *Treasure Island*; Burroughs, *Sharp Eyes*; Irving, *Sketch Book*. For supplementary reading—Longfellow, *Evangeline*; Scott, *Ivanhoe*; and *The Talisman*; Hale, *Man Without a Country*; Mark Twain, *Tom Sawyer*; Jack London, *Call of the Wild*; Wells, *War of the Worlds*.

SECOND YEAR

COMPOSITION AND GRAMMAR: The principles of composition applied to the sentence and the paragraph; choice of effective words; correct usage; figures of speech.

LITERATURE: For close study and class room discussion—Coleridge, *Ancient Mariner*; Lowell, *Vision of Sir Launfal*; Tennyson, *Idylls of the King*; George Eliot, *Silas Marner*; Shakespeare, *Julius Caesar*; Addison, *The Sir Roger de Coverley Papers*; Hearn, Kotto.

For supplementary reading—Scott, *Lady of the Lake*, *Kenilworth*; Blackmore, *Lorna Doone*; Irving, *Capt. Bonneville, or Tales of a Traveler*; Kingsley, *Westward Ho*; Dickens, *Oliver Twist*; Poe, *Short Stories*; Holmes, *Elsie Venner*.

THIRD YEAR

COMPOSITION AND RHETORIC: Principles of Rhetoric applied to structure of expository themes and informal argument; topical outlines; analysis of essays studied in class.

LITERATURE: Dickens, *David Copperfield*; Macaulay, *Essays on Addison and Johnson*; Wordsworth, *Short Poems*; Milton, *Short Poems*; Shakespeare, *Twelfth Night*, *Macbeth*; Spenser, *One Book of Faerie Queene*; Chaucer, *Prologue*.

FOURTH YEAR

A course in Public Speaking: Oral debates, formal and informal, based on briefs; analysis of speeches of Lincoln and Burke; parlia-

mentary usage; oral narration; digests of stories and personal adventures; after-dinner speeches; presentation speeches; and various kinds of occasional addresses; frequent opportunity to speak before the entire preparatory department.

MATHEMATICS

ALGEBRA. First year: Introduction, factoring, fractions, simple equations, simultaneous equations, and special problems. Second year: Involution, evolution, theory of exponents, radicals, quadratic equations, and proportion. The ground covered by these two years will be required for entrance to the engineering courses in college.

PLANE GEOMETRY. Third year: Emphasis is laid on thorough work in original exercises. **SOLID GEOMETRY.** Second semester, fourth year, with original exercises.

MECHANIC ARTS

This work consists of both drawing and shop work, between which subjects the student's time is about equally divided. The course covers one year and is designed to furnish a thorough elementary knowledge of manual training as taught in the secondary schools of the country.

DRAWING. Freehand sketching in perspective and orthographic projection. Reinhart's lettering, freehand working drawings. Mechanical drawing and geometrical problems.

SHOP WORK. "Sloyd," care and use of woodworking tools. Forging, joinery, wood turning.

SCIENCE

It is the object of the courses in science to initiate the student into the processes and methods used in laboratory work; to teach close observation, careful manipulation and logical deduction; to acquaint the student with the fundamental facts of the various branches of science and to give full practice in the use of good English in describing various observations and experiments. To insure better results in the notebooks, they will all be passed upon by one of the instructors in English.

PHYSICAL GEOGRAPHY—Omitted, 1912-13.

This course, combining the laboratory method with the text-book,

aims to give the pupils training in exact observation of familiar phenomena, like distance, weight, pressure of liquids and gases, temperature, winds, clouds, and the habits of plants and animals; erosion, formation of soil, and rocks; plant growth.

BIOLOGY

The course extends through the year, botany being offered the first semester, zoology the second. The plant is studied as a living individual in all its relations; plant societies and plant groups. Text, Coulter, *Plant Studies*. Types of invertebrates and vertebrates are studied in regard to anatomy, physiology, habits, etc. Text, Kellogg, *The Animals and Man*.

CHEMISTRY

A year's work with the text and in the laboratory, in such proportions as the instructor decides upon. Each student must keep a notebook in which he describes the process and results of his laboratory work.

PHYSICS

The course aims to show that physics is not something abstract or mysterious, but is the simple explanation of everyday occurrences not usually understood and often unnoticed. It consists of three recitation periods and four laboratory periods per week, carried on along the lines laid down for the senior year in secondary schools. Each student must keep a notebook in which a minimum number of experiments must be written up.

HISTORY

The aim of the work in history is to lead the pupil to see the development of races and nations along political, social, and religious lines, and to arouse in him a love for the subject and a habit of broad and discriminating reading.

The work of the first year consists of a survey of the development of the characteristics of the Greek and Roman civilizations. A text such as Wolfson, *Essentials of Ancient History*, or West, *Ancient History*, will be supplemented by collateral reading and a notebook.

The work of the second year includes mediaeval and modern history. The aim is to give the student an idea of the essential unity of

history and the leading facts in the political development of races and nations. Harding, *Essentials of Mediaeval and Modern History*, is used, supplemented by library work. Omitted 1912-13.

Hart, *Actual Government*, or Foreman's *Advanced Civics*, is the textbook in civics. The historical development of the subject is made prominent, while practical problems, such as taxation and municipal government, are made the subjects of special investigation and study. The text in history will be James and Sanford, *American History*, or Channing, *Students' History of the United States*.

LATIN, GREEK, FRENCH, GERMAN, AND SPANISH

One of these languages must be begun in the first or second or third year, and be pursued for at least two years.

For an outline of the courses in Latin and Greek see page 38, under requirements for admission.

For an outline of the courses in French, Spanish and German, see pages 80, 83, and 101.

BOOKKEEPING AND COMMERCIAL PRACTICE

Bookkeeping is taught by the modern budget system. The work is individual and each student may progress as fast as his time and ability permit. The course is thorough in all the details of office practice. Students are made familiar with different filing cabinets, the filing of letters, the use of card ledgers, and indexing. All students in bookkeeping are required to take some other branch of mathematics and must show proficiency in English.

STENOGRAPHY AND TYPEWRITING

A complete course in stenography is offered. The object of the course is to train students so that they may become practical stenographers. With this end in view particular stress is laid upon neatness, filing, copying and indexing. This branch of the commercial department is equipped with up-to-date filing cases, and seven standard make typewriters of latest models. *Students taking this work are required to have had one year of High School English, and to take English with this course.*

AGRICULTURE

The following courses in Agriculture may be elected by preparatory students: Agr. 1 (Plant Culture), Agr. 2 (Farm Crops), Agr. 3 (Live Stock Judging), Agr. 4 (Elements of Dairying), Agr. 14 (History of Breeds), Agr. 15 (Poultry).

Any two of the above half-year courses will count one credit in the preparatory course. For description of the courses, see pages 53 to 59.

THE DRACHMAN PRIZE

To assist students in gaining a college education and to encourage scholarship, Mr. Harry A. Drachman, of Tucson, has for two years offered to the students of the University two annual cash prizes of \$25 and \$15 respectively, the contest open to all students of the University.

During the academic year 1910-1911, the prizes were offered for the two best debates. For the present academic year they are offered for the two best theses written upon some subject of historical or practical importance in Arizona. No limits are set for the length of the theses, but they will be judged for originality of investigation and logical development of subject matter. The literature dealing with political, social, historic, and economic problems of the Southwest, collected by the Department of Economics, is available for all students competing for these prizes.

DONATIONS TO THE UNIVERSITY DURING THE YEAR 1911-1912

During the current year the Chamber of Commerce of Prescott, Arizona, has donated the sum of \$250 for a set of iron gates for the main entrance to the campus.

The Students' Loan Fund, now amounting to \$610, has been created by the gifts of the following citizens of Tucson: Messrs. Leo Goldschmidt, Fred Fleishman, Nathaniel E. Plumer, Albert Steinfeld, John W. Estill, Dr. William V. Whitmore, Samuel Heineman, and Levi H. Manning.

The valuable series of athletic prizes presented during the year to the Athletic Association of the University are the gift of Albert Steinfeld & Company. Messrs. Myers & Bloom presented a loving cup as

a trophy for the football victory at Albuquerque. Mr. Phil C. Brannen donated a large athletic pennant. Dr. George D. Troutman has donated two medals for work of special merit in chemistry; Mr. Harry A. Drachman has continued the prizes announced previously of \$25 and \$15 for meritorious discussions of public questions; the Federated Women's Clubs of Arizona have increased their scholarship to \$75; and Mr. John M. Ormsby of Tucson has presented to the University a new flag, ten feet by twenty in size, for the military department.

MILITARY ORGANIZATION—FEBRUARY, 1912

CAPTAIN HIRAM M. POWELL, U. S. A., Commandant of Cadets

STAFF

Act. Adjutant....F. L. Culin, Jr.	Act. Color Sgts....W. D. Bird
Act. Sgt. Major.....F. Mack	R. L. Lutgerding

COMPANY A

Captain.....L. D. LaTourrette	Sergt.....A. D. Micotti
1st Lieut.....F. L. Culin, Jr.	Sergt.....E. W. Pistor
2nd Lieut.....H. Aylworth	Corp.....C. W. Isbell
1st Sergt.....H. L. Underhill	Corp.....L. F. Cloud
Sergt.....W. Duane Bird	Corp.....M. T. Kendall
Sergt.....W. E. Hatcher	Corp.....A. B. Perkins

COMPANY B

Captain.....C. H. Rolfe	Sergt.....F. Mack
1st Lieut.....F. W. Rodgers	Sergt.....V. G. LaTourrette
2nd Lieut.....J. F. Burns	Corp.....J. H. Schoshusen
1st Sergt.....C. E. Scheerer	Corp.....J. Stewart
Sergt.....L. C. Brichta	Corp.....W. M. Brewer
Sergt.....R. L. Lutgerding	Corp.....C. R. Jones

MUSICIANS—Drum Major, Marcus Ming

Trumpeter, Corp. C. F. Simonds	Drummer.....F. A. Ehleb
Trumpeter.....L. S. Hedges	Drummer.....F. Hobson
Trumpeter...A. W. Olcott, Jr.	Drummer.....W. L. Jenney
Trumpeter.....A. A. Murillo	Drummer.....L. Lefko

ALUMNI REGISTER

The Alumni Association of the University of Arizona, organized on the second day of June, 1897, represents the body of graduates of the University; its object, as expressed in its constitution, is "To promote the interests of the University, to secure unity among its graduates and to foster an attachment to our Alma Mater."

1895

Charles Oma Rouse, B. S. Died 1906.

Mercedes Anna Shibell, B. S., (Mrs. A. J. Gould), Tucson.

Mary Flint Walker, B. S., (Mrs. Pearl Adams), Benson.

1897

Edward Marshall Boggs, C. E., (*nunc pro tunc*), Chief Engineer Oakland Electric Railways, Oakland, California.

Clara Cramond Fish, B. S., (Mrs. F. C. Roberts), Tucson.

George Ojeda Hilzinger, B. S., Attorney, Tucson.

Mark Walker, B. S., Metallurgist, 211 W. First St., Los Angeles.

1898

Hattie Ferrin, B. S., (Mrs. Charles Solomon), Safford.

Granville Malcolm Gillett, B. S., Chief Clerk in Surveyor General's Office, Phoenix.

Minnie Watts, B. S., (Mrs. W. B. Smith), Altaville, California.

John Desha Young, B. S. Died 1899.

1899

Robert L. Morton, B. S., Assayer, Yuma.

1900

Ida Clarissa Flood, B. S., (Mrs. G. Dodge), Tucson.

Samuel Pressly McCrea, B. S., A. B., Principal of High School, Redwood City, California.

Charles Pierce Richmond, B. S., Mining Engineer, Phoenix.

Florence Russell Welles, B. S., (Mrs. Wm. Angus), Los Angeles, California.

1901

Rudolph Castaneda, B. S., Engineer, Nacozari, Sonora, Mexico.

Clara Ferrin, B. S., Teacher, Tucson.

George Millard Parker, B. S., Denver, Colorado.

David Hull Holmes, B. S. (nunc pro tunc), Architect, Tucson.

1902

Andrew Gilbert Aiken, A. B., B. S., Surveyor, Canton, New York.

Moses Blumenkranz, B. S., Mining Engineer, El Paso, Texas.

Ruth Brown, Ph. B., (Mrs. Wilkins Manning). Died 1910.

Felix Grundy Haynes, B. S., Ethanaca, California.

Rose Belle Parrott, Ph. B., Teacher, Roseburg, Oregon.

Phillip Matthem Reilly, B. S.

Bertram L. Smith, B. S., Engineer, Phoenix.

Bessie Smith, Ph. B., (Mrs. Earle Davis), Douglas.

Walter James Wakefield, B. S. (Mining), Manager Tucson Warehouse and Transfer Co., Tucson.

1903

Advanced Degrees:

LL. D., Hon. William Herring, Tucson.

M. A., John William Gorby, (B. A., Marietta), Chicago, Illinois.

M. A., Benjamin Franklin Stacey, (B. A., B. D., Lombard), Teacher, Pasadena, California.

Richard Lamar Drane, B. S., Assistant Engineer Randolph Lines, Tucson.

George Mark Evans, (LL. B., Michigan), Ph. B., Teacher, Los Angeles, California.

Leslie Alexander Gillett, B. S. (Mining), U. S. Mine Inspector, Santa Fé, New Mexico.

Georgia Ann Holmesley, Ph. B., Teacher, Clifton.

Edward Horton Jones, B. S., Assayer, Denver, Colorado.

John Willard Prout, Jr., B. S., General Manager Santa Cruz M. and S. Co., Mowry.

Thomas Edward Steele, B. S., Assayer, Sasco.

1904

William Burnham Alexander, B. S., Civil Engineer, Tucson.
Elbert John Hollingshead (Kimble), B. S., Clerk, Seattle, Washington.

Estella Markham (Prout) Kirkpatrick, Ph. B., Light.
John Willard Prout, Jr., B. S. (Mining), see 1903.

1905

Ora Elinor Norway, Ph. B. Died 1908.

1906

Advanced Degree:

M. S., William B. Begg, (A. B., Toronto), Philippine Islands.

Chester Bennett Clegg, B. S. (Civil Engineering), Phoenix.

John Wesley Gebb, B. S., Engineer, 1401 Santee St., Los Angeles.

Roy Bartley Kilgore, B. S. (Mining), Seattle, Washington.

Roy Gibbons Mead, B. S. (Mining), 2261 Shattuck Ave., Berkeley, Cal.

Roy Webb Moore, B. S. (Mining), Mining Engineer, Tucson.

Carobel Murphey, (A. B., Cox College), Ph. B., Teacher, Whittier, Cal.

Ida Christina Reid, Ph. B., Instructor, University of Arizona, Tucson.

Minnie Louise Wooddell, Ph. B., Teacher, Tucson.

1907

Advanced Degree:

Engineer of Mines, John Willard Prout, B. S., (Mining). See 1903.

Charles Alexander, Ph. B., Teacher, Tempe.

Harriet Estella Brown, Ph. B., Teacher, Tucson.

Lawrence Brodhead Croasdale, B. S. (Mechanical Engineering), Draughtsman, Delaware Water Gap, Pa.

Weda Ina Purcell, Ph. B., (Mrs. Ivy Marshall), San Francisco, California.

Hugh Maupin Wolfkin, B. S., Engineer U. S. Bureau of Mines,
Billings, Montana.

1908

Honorary Degree:

LL. D., William Phipps Blake, Sc. D., Tucson. Died 1910.

Carroll Pitkin Bradstreet, B. S., Pachuca, Mexico.

Benjamin Scott Dinsmore, B. S., Miami, Arizona.

William Arthur Tarr, B. S. (Mech. Eng.), Oklahoma, (Agricultural); B. S. (Mining), Instructor in Economic Geology, etc., University of Missouri, Columbia, Mo.

Hugh Maupin Wolfkin, B. S. (Mining). See 1907.

Leigh Ernest Worthing, B. S., Bay City, Michigan.

1909

Burrell R. Hatcher, B. S. (Mining), Mining Engineer, Oracle.

Ethel A. Hooper, Ph. B., Tucson.

Grace Ysabel LaBaree, Ph. B. Died 1910.

Anita Calneh Post, Ph. B., Teacher, Yuma.

John Mosheim Ruthrauff, B. S. (Metallurgy), Tucson.

Arthur Perry Thompson, B. S. (Mining), Columbia University, New York City.

Mabel Wilkerson, Ph. B., Recorder's Office, Tucson.

1910

Ernest Orrin Blades, B. S. (Mining), Draftsman, Tucson.

Lawrence Arthur Callaway, B. S. (Mining), Lexington, Ky.

Miles Miller Carpenter, B. S.

Fletcher Morril Doan, B. S. (Mining), Llanos de Oro, Sonora.

Ida Whittington Douglass, Ph. B., Tucson.

Warren Arthur Grossetta, B. S. (Mechanical Engineering).

Joseph Clyde Hoyt, B. S. (Mining), Assistant Mining Engineer, Jerome.

Leslie Creighton Millar, B. S., Minneapolis, Minnesota.

Willard Henry Nash, B. S., 406 W. Ferry St., Buffalo, New York.

R. Izer Turner, Ph. B., 543 W. Chestnut St., Anaheim, California.

1911

- Phebe May Bogan, A. B., Tucson.
Miles Miller Carpenter, Engineer of Mines, via Cave Creek Stage,
Phoenix.
Ralph Waldo Harrison, B. S., Ashland, Wis.
Miner Louis Hartman, B. S., 1001 So. 5th St., Champaign, Ill.,
Assistant Instructor in Chemistry.
Katherine Florence Kitt, A. B., Tucson.
Duane Rebstock, B. S., Phoenix.
Jane Herbst Rider, B. S. (Civ. Eng.), Tucson.
Frank Winfred Rose, B. S. (Mining), Clifton.
Ivy Mae Purcell, A. B., Tucson.
Janet Volume Sine, A. B., Tucson.
Leon Henri Strong, A. B., Tucson.

REGISTER OF STUDENTS

GRADUATE STUDENTS

- Chappell, Harold.
Kilgour, Bertha F.
Moore, Roy W.
Strong, Leo Henri.
Thorpe, Clarence Dewitt
Wentworth, Marian Seabury—6

SENIORS

- Bogert, Jessie.
Bone, James Lee.
Bryan, W. Jennings, Jr.
Flanagan, James Joseph.
Geringer, John Charles.
Geringer, Otto George.
Goodrich, Catherine.
Lusk, Harry Wilton.
McDole, Maynard Matthew.
McNeil, Clara May.
Menge, Edward John.
Nishihara, George S.
Pratt, George Howard.
Purcell, Ella Marie. —14

JUNIORS

- Barnes, Ernest Lee.
Barrett, James Taylor.
Brown, Marguerite.
Cochran, Horace Merle.
Coles, Henry Oliver.
Estill, Howard Wilmot.
Foster, Henry Alden.
Johnston, John M.
Kelly, Helena M.
LaTourrette, Lyman D.
Lindley, James Gary.
Lovejoy, Arthur Luccock.

Lowdermilk, Walter C.
 McClure, John Englebright.
 Merritt, Richard.
 Munds, William Harold.

Schoonmaker, Hazel L.
 Wilkey, L. Guy.
 Young, Ralph Crawford. —19

SOPHOMORES

Aylworth, Herbert Rolland.
 Batte, Benjamin Homer.
 Bernhard, Durward Isaac.
 Blake, Harry Ed.
 Burns, Joseph Frederick.
 Caballero, Augusto Davis.
 Culin, Frank Lewis, Jr.
 Hatcher, William Ernest.
 Humeston, Harold Bruck.
 Hunt, Sam L.
 Jones, Alice Louise.
 Knapp, Juna Marie.

LaTourrette, Verne Gerald.
 McCurdy, Howard Vincent.
 MacPherson, Maud.
 Micotti, Alfred D.
 Moore, Mabel M.
 Mullen, Alfred John.
 Pistor, Carl.
 Rogers, Frederick William.
 Swan, Laura May.
 Thrift, Inez Esther.
 Whittington, Frank S.
 Wooddell, Grace Helen. —24

FRESHMEN

Backstein, Rytha Ferdinand.
 Balderas, Charles Barromes.
 Barkley, Bessie Jewell.
 Benedict, Arthur Allen.
 Bird, Walter Duane.
 Blake, Gertrude Mearie.
 Brewer, Walter Martin.
 Brichta, Louis Chambro.
 Cameron, Alice Faith.
 Campbell, William Riggs.
 Carter, Mabel Ruth.
 Curry, Esther May.
 De Arozena, Joe.
 Duffy, Catherine Gertrude.
 Ehleb, Frank A.
 Goodman, Robert A. B.
 Goyette, Charles Edgar.

Halbert, Andrew Jackson.
 Hayhurst, Normal Clifton.
 Hofmeister, Irene Louise.
 Hurley, Bert Cornelius.
 Jackson, Lawrence Richard.
 Jones, Collins Ray.
 King, William Charles.
 Lefko, Louis.
 Lutgerding, Robert Linville.
 Lynch, Eugene Read.
 McDermott, Morgan Bland.
 McIntosh, Jay Angus.
 Mack, Francis Caquin.
 Mashbir, Sidney F.
 Maxwell, Franklin Rufus.
 Meguire, Alva Frank.
 Minister, Percy Frank.

Murphy, Edward Burton.
Oxley, Edward Burton.
Pickett, Charles Edgerton.
Pusch, Maybelle.
Pilcher, Cornilla.
Ries, Howard Cuyler.
Rigg, Ralph Lee.
Roberts, Cherange Sylvia.
Rockfellow, Julia.
Roletti, Gabriel Elias.

Rolfe, Clifton Howard.
Savage, Harold Curtis.
Scheerer, Cedric Ezra.
Schoshusen, John H. E.
Smith, Glen.
Sullivan, James Daniel.
Taylor, William Henry, Jr.
Underhill, Howard Lawrence.
Walker, Norma Pauline. —53

UNCLASSIFIED

Barthels, Frederick.
Bean, Milo Walter.
Brainard, Bessie Evangeline.
Boucher, Marie.
Brown, Rollin.
Busch, Charles Richard.
Clark, F. M.
Cooper, Mildred Spillman.
Cordis, Samuel Lee.
Covert, Penelope L.
Dasser, Katherine.
Davis, Jerry George.
Drachman, Florence Emilie.
Drachman, Myrtle Augustine.
Duff, Thomas A.
Evans, H. E.
Fox, Edward L.
Frazier, Allegra.
Frey, Florence Merriam.
Fullerton, Ethel.
Glenn, Eliza Gladys.
Griggs, Flora Stewart.
Hansen, Harold Neil.
Hartley, Isabel Alice.
Hawke, George Thomas.
Hawkins, Jack Eugene.

Hendry, William Seaton.
Henley, Mary Luty.
Herald, Florence.
Hess, Nina N.
Highfill, Ernest Raymond.
Hopkins, Joseph William.
Horstmann, Edna.
Houghton, Therese Gertrude.
Hughston, Caroline Mary.
Jeffries, Caswell Millard.
Johnson, Edward Eugene.
Jones, Donald F.
June, Irma Lucile.
Kellond, Annie Wilder.
Kellond, Oswald Alfred.
Kengla, Hermann Waltemath.
Kizer, Pearl.
Larsson, Elda Marie.
Lauder, Edith Hocker.
Lauder, C. F.
Lawson, Alice Patton.
Lowenthal, Louis William.
McCoy, Henry Patrick.
McElroy, John E.
Melton, Mary.
Miller, Helen M. A.

Murphy, Elizabeth Bivins.
Perkins, Arthur B.
Pitt, Anna Merriam.
Phillipson, Andrew Martin.
Purves, Alice M.
Richardson, Marian.
Roberts, Emie Allen.
Rogers, Anne E. Paget.
Roletti, Charles.
Ropes, Mary Katherine.
Russell, Frances Keith.
Satterwhite, Alice M.
Shurtleff, Mrs. George F.
Siewert, Elsie Marie.
Sloan, Ethel Elynne.
Spoehr, Florence Mann.

Sroufe, Cornelia Meade.
Steele, Harold.
Studebaker, Emily Leslie.
Studebaker, Hadley.
Talcott, William Ariel.
Tattersfield, Eric Monthan.
Thompson, Louise.
Treat, Attie Atnacia.
Upham, Gains John.
Van Hoose, Grant.
Wick, Mabel.
Wilcox, Cecyl Cleora.
Wildman, Arthur H.
Wolverton, Sarah Foss.
Woodell, Geo. Hogan.
Wright, Edith F.

—84

FOURTH PREPARATORY

Bennie, John Willis.
Carter, Charles Lyndell.
Cloud, Leo F.
Deering, John J.
Hobson, Francis Joseph, Jr.
Hobson, Harry Townsend.
Isbell, Charles Woodruff.
Kendall, Marcus Todhunter.
Manning, Melissa Evalina.

Nave, Lillian.
Purcell, George William.
Rebeil, Paul.
Shields, Harold.
Simonds, Charles F.
Smith, Harvey Partridge.
Wakefield, Edith.
Warner, Grant B.

—17

THIRD PREPARATORY

Catron, Gertrude Leona.
Davey, George Keith.
Glenn, John Brooks.
Grimes, Walter Gordon.
Hertel, Elmer Joseph.
Hogan, Catharine.
McGrath, Amy.
Munds, Sadie Grace.

Pendleton, Edwin Conway.
Rebeil, Andrew J.
Renaud, Ernest James.
Stewart, Jeb.
Terrell, Alfred Yorke.
Troutman, Roy Robert.
Wheeler, Buckley Adams.
White, Arthur S.

—16

SECOND PREPARATORY

Blake, Mabel Annette.

Branaman, William Stephen.

Glenn, Elizabeth Gladys.	Olney, Dan Clinton.
Hedges, Lawrence.	Rea, Frances.
Jenney, William Le Baron.	Sykes, Eugene Knight.
Jennings, Curtis Arthur.	Washburn, Reginald Foshay.
Morgan, Florence Belle.	Wilkerson, Edith. —13
Olcott, Arthur W.	

FIRST PREPARATORY

Abrams, Harry W.	Logan, Douglas Elvin.
Blake, John Walter Philip.	Moses, Maurene Esther.
Blanc, Olivia Olga.	Roberts, Carl Weston.
Brady, Aneta Patricia.	Ryan, Emmet Edward.
Clarke, A. Lincoln.	Simonds, Hattie.
Clarke, Herbert Stratton.	Tomiyori, Frank R.
Fusom, Robert Seward.	Towner, Jesse Wintermute.
Griggs, Cecil Wallace.	Velasco, Joseph Felix.
Jones, R. Wilson.	Williams, Roy Leo.
Lamoreaux, David C.	Wood, Herbert Riddock. —20

UNCLASSIFIED PREPARATORY

Brady, Arthur Richard.	McReynolds, W. B.
Chafin, Desdemona Eleanor.	Maldonado, Miguel.
Christensen, Elmer William.	Murillo, Angel A.
Collins, Bernardine Marie.	O'Connell, Mildred Lueza.
Davis, Minnie Carmen.	Powers, Helen.
Evans, Gladys Lorette.	Rowell, Robert Strong.
Garwood, Julia Anna.	Smith, Harry Tracy.
Granillo, Jesus.	Thompson, Ellen Jane.
Henley, Dudley Custer.	Tomiyori, Frank R.
Hicks, William James.	Udall, Gladys Madge.
Jones, Wilson R.	Treat, A.
Kraft, Louis.	Upham, Lydia Adella Reiner.
Larriva, Benito.	Woo, Margaret.
Lockhart, Pearle Louise.	Zander, Ramona Irene. —29
Lummis, Turbese Dorothea.	

SHORT COURSE IN AGRICULTURE

Henley, William J., Jr.	McGuffin, John Benjamin.
Maldonado, Ramon Lopez.	Ming, Marcus A. L.
McKinnon, William Joseph.	Williams, Benjamin Joseph. —6

INDEX

- Admission, 33-38.
Advanced Standing, 37.
Agriculture, 19, 41, 51, 101, 117.
Agricultural Experiment Station, 103.
Alumni Register, 121.
Astronomy, 26, 59.
Assaying, Fees, 105, 106.
Bachelor of Arts, Degree, 40.
Bachelor of Science, Degree, 41; B. S. in Agriculture, 41-43; in Civil Engineering, 44; in Metallurgy, 48; in Electrical Engineering, 45; in Mechanical Engineering, 47; in Mining Engineering, 50.
Biology, 21, 116.
Board, 30.
Bookkeeping, 117.
Buildings, 11.
Botany, Admission, 37; College, 60.
Bureau of Mines and Assaying, 105.
Calendar, 2.
Certificates of Admission, 38.
Chemistry, 21.
Chemistry, Admission, 37; College, 62.
Civil Engineering, 22, 44, 64.
Climate, 10.
Degrees, Advanced, 51.
Degrees, Courses of Study for, 39.
Discipline, 30.
Dormitories, 30.
Drachman Prize, 118.
Economics, 69.
Electrical Engineering, 24, 45, 72.
Electives, Admission, 37.
Endowment, 14.
English, Admission, 34; College, 75.
Expenses, 31.
Faculty, 3.
Fees, 31; for Assaying, 106; for Ore Testing, 107.
French, Admission, 36; College, 78.
Geology, 79.
German, Admission, 36; College, 81.
Gifts, 118.
Greek, Admission, 36; College, 83.
Gymnasium, 13, 27.
History, Admission, 35, 116.
History, College, 83.
Holidays, 30.
Laboratory Fees, 32.
Latin, Admission, 36; College, 85.
Library, 14.
Library Building, 11.
Loan Funds, 32.
Location, 10.
Maintenance, 13.
Mathematics, Admission, 35; College, 85.
Mechanic Arts, 23, 87.
Metallurgy, 12, 25, 48, 90.
Mechanical Engineering, 24, 47, 88.
Military, 28, 120.
Mineralogy, 26, 92.
Mine Surveying, 50.
Mines, School of, 29.
Mining Engineering, 50, 93.
Museum, 11, 18.
Normal Schools, Admission from, 38.
North Hall, 12.
Ore Testing, Fees, 107.
Organization, 8.
Petrography, 26.
Philosophy, 95.
Physical Geography, 37, 115.
Physical Training, 96.
Physics, 26.
Physica, Admission, 37, 116; College, 98.
Preparatory Department, 109.
Records, 29.
Regents, 3.
Register of Students, 125.
Registration, 29.
Science Hall, 11.
Short Course in Agriculture, 101.
South Hall, 12.
Spanish, Admission, 36; College, 99.
Stenography, 117.
Typewriting, 117.
University Hall, 11.
Vacations, 30.
Women's Dormitories, 12.
Zoology, 100.

THE University of Arizona
Record is published by the
University monthly during
the academic year.

Entered as Second-Class Mat-
ter at the Postoffice at Tucson,
Arizona, under the Act of July
16, 1894.

University of Arizona
Record

VOLUME VI, NUMBER 6

APRIL, 1913

REGISTER
1912-13

WITH ANNOUNCEMENTS
1913-14

PUBLISHED BY THE
UNIVERSITY OF ARIZONA
TUCSON, ARIZONA

Other circulars are issued by the University which will be forwarded on application to the President of the University:

"Why Go to College?"

The Annual Report of the Regents.

Monthly editions of the University Record, issued often in the form of broadsides, containing current news of the University.

Copies of "University Life," the student newspaper, will be sent to those who request them.

"El Suhuaro," the student annual, may be ordered through the President of the University, the price being \$1.50 the copy.

University of Arizona

REGISTER

1912-13

WITH ANNOUNCEMENTS FOR
1913-14

TUCSON, ARIZONA

1913

440

CALENDAR

1913

Sept. 15 and 16, Mon. and Tue.	Registration Days
Sept. 17, Wed.	Class work begins
Sept. 27, Sat.	Condition examinations
Nov. 27, Thu.	Thanksgiving Classes have regular sessions. Fri. and Sat., Nov. 28 and 29.
Dec. 23, Tue., 11:00 a. m.	Holiday recess begins

1914

Jan. 5, Mon.	Instruction resumed
Jan. 10, Sat.	Condition examinations
Jan. 28, 29, 30, 31	First semester examinations
Feb. 2, Mon.	Second semester begins
May 16, Sat.	Condition examinations
May 30, Sat.	Holiday
May 31, Sun.	Baccalaureate discourse
June 1, Mon.	Commencement

Sept. 14, 15, Mon. and Tue.	Registration Days
Sept. 16, Wed.	Class work begins

OFFICERS OF ADMINISTRATION, INSTRUCTION AND INVESTIGATION

BOARD OF REGENTS

EX-OFFICIO

HIS EXCELLENCY, GEORGE W. P. HUNT.....	Phoenix
Governor of Arizona	
THE HONORABLE CHARLES O. CASE.....	Phoenix
Superintendent of Public Instruction	

APPOINTED

ALBERT L. WATERS, Chancellor and President.....	Tucson
FRANK H. HEREFORD, Treasurer.....	Tucson
LOGAN W. WHEATLEY.....	Tucson
LEWIS D. RICKETTS.....	Globe

FACULTY

ARTHUR HERBERT WILDE, Ph. D., President.	President's House
B. A. 1887, Boston Univ.; M. A. 1899, Ph. D. 1901, Harvard	
Professor of History. 1911	
ROBERT HUMPHREY FORBES, M. S.	105 Olive Road
B. S. 1892, M. S. 1895, Illinois	
Director and Chemist, Agricultural Experiment Station. Director of Agricultural Instruction. 1894	
FRANK NELSON GUILD, M. S.	107 Olive Road
B. S. 1894, M. S. 1903, Vermont	
Professor of Chemistry and Mineralogy. 1897	
GEORGE EDSON PHILIP SMITH, C. E.	1195 Speedway
B. S. 1894, C. E. 1899, Vermont	
Irrigation Engineer, Agricultural Experiment Station. 1907	
JOHN JAMES THORNBER, A. M.	109 Olive Road
B. S. So. Dak. Agr.; B. S. 1897, A. M. 1901, Nebraska	
Professor of Biology; Botanist, Experiment Station. 1901	
WILLIAM WHEELER HENLEY, A. B.	First St., near Vine St.
A. B. 1905, Stanford	
Professor of Mechanical Engineering and Mechanic Arts. 1905	
*ANDREW ELlicott DOUGLASS, Sc. D.	
A. B. 1889, Sc. D. 1908, Trinity	
Professor of Physics and Astronomy. 1906	

*Dates following titles indicate appointment to service in the University.

ALBERT EARLE VINSON, Ph. D.	914 N. Fourth Ave.
B. S. 1901, Ohio State; Ph. D. 1905, Gottingen Biochemist, Agricultural Experiment Station.	1905
CHARLES ALFRED TURRELL, A. M.	835 Tyndall Ave.
B. S. 1896, Nebraska; A. M. 1901, Missouri Professor of Modern Languages.	1904
FREDERICK W. WILSON, B. S.	Experiment Station Farm, Phoenix
B. S. 1905, Kansas (Agricultural) Animal Husbandman, Agricultural Experiment Station.	1905
LESLIE ABRAM WATERBURY, C. E.	1405 Speedway
B. S. 1902, C. E. 1905, Illinois Professor of Civil Engineering.	1907
ROBERT RHEA GOODRICH, M. S.	645 E. Third St.
B. S. (Mining) 1885, B. S. (Mechanical Eng.) 1901, M. S. 1902, Mass. Inst. of Technology Professor of Mining Engineering and Metallurgy.	1907
ROBERT WAITMAN CLOTHIER, M. S.	639 N. Park Ave.
B. S. 1897, M. S. 1899, Kansas (Agr.) Professor of Agriculture.	1907
ERNEST SUTHERLAND BATES, Ph. D.	908 Speedway
A. B. 1902, A. M. 1903, Michigan; Ph. D. 1908, Columbia Professor of English.	1908
HENRY ALFRED ERNEST CHANDLER, B. S.	North Hall
B. S. 1905, Northwestern Professor of Economics and History.	1908
HIRAM McL. POWELL.	876 E. Third St.
Captain U. S. A. 1890, West Point Professor of Military Science and Tactics.	1909
GEORGE FOUCHE FREEMAN, B. S.	817 E. Fifth St.
B. S. 1903, Alabama Polytechnic Institute Plant Breeder, Agricultural Experiment Station.	1909
AUSTIN WINFIELD MORRILL, Ph. B.	235 W. Monroe St., Phoenix
B. S. 1900, Ph. D. 1903, Mass. Agricultural College Entomologist, Agricultural Experiment Station.	1909
NATHAN CESNA GRIMES, A. M.	113 Olive Road
A. B. 1906, Michigan; A. M. 1909, Wisconsin Professor of Mathematics; Registrar.	1910
FRANCES MELVILLE PERRY, A. M.	1207 Speedway
B. A. 1891, A. M. 1893, Butler Professor of English.	1910
CHARLES ARTHUR MESERVE, Ph. D.	432 Speedway
B. S. 1895, Mass. Inst. of Tech.; Ph. D. 1899, Univ. of Erlangen Professor of Bacteriology and Extension Lecturer on Foods and	Food Chemistry.
	1912

MARION CUMMINGS STANLEY, B. L.	Center St. near Speedway B. L. 1900, M. L. 1909, California
Assistant Professor of Philosophy.	1902
LEVONA PAYNE NEWSOM, Ph. D.	Fourth St. and Euclid Ave. A. B. 1892, Ph. D. 1895, Franklin
Assistant Professor of Latin and Greek.	1905
WILLIAM GEORGE MEDCRAFT, A. M.	726 E. Fifth St. A. B. 1898, A. M. 1904, Kansas Wesleyan
Assistant Professor of Mathematics.	1905
WILLIAM LUCIUS FOWLER, B. S.	South Hall B. S. 1909, Missouri
Assistant Professor of Animal Husbandry.	1909
ALEXANDER McOMIE, B. S.	826 E. Fourth St. B. S. 1910, Utah
Assistant Agriculturist, Agricultural Experiment Station.	1910
PAUL HENRY MALLET-PREVOST BRINTON, M. S.	115 Olive Road 1909, Graduate of Chemisches Laboratorium Fresenius, Wiesbaden; B. S. 1911, M. S. 1912, Minnesota
Assistant Professor of Chemistry.	1912
FRANK CALEB KELTON, B. S.	412 E. Fourth St. B. S. 1904, Arizona
Assistant Professor of Civil Engineering.	1909
ESTELLE LUTRELL, A. B.	731 No. First Ave. A. B. 1896, Chicago
Instructor in English, Librarian.	1904
IDA CHRISTINA REID, Ph. B.	East Cottage Ph. B. 1906, Arizona
Instructor in History and Mathematics; Principal of the Sub-Collegiate Department.	1906
FRANK LEWIS KLEEGER, B. S.	B. S. 1908, California
Instructor in Chemistry and Physical Training; Director of the Gymnasium.	1908. Resigned, December, 1912
JAMES GREENLEAF BROWN.	937 No. Fifth Ave. Instructor in Botany.
WILLIAM JAMES GALBRAITH, JR., A. B.	1909 725 E. Fourth St. A. B. 1906, Stanford; J. D. 1908, Chicago
Instructor in Law and in Physical Training.	1909
BERT AUGUSTUS SNOW, B. S., M. E.	803 E. Seventh St. B. S. 1907, Colorado (Agr.); M. E. 1910, Cornell
Instructor in Electrical and Mechanical Engineering.	1910
ARTHUR HAMILTON OTIS, A. B.	521 E. Third St. A. B. 1908, Columbia
Instructor in Modern Languages.	1911

DONALD FORSHA JONES, B. S.	803 E. Seventh St.
B. S. 1911, Kansas (Agr.)	
Assistant Plant Breeder in Experiment Station.	1911
CHARLES FRANCIS WILLIS, B. S.	721 E. Fourth St.
B. S. 1906, Mass. Institute of Technology	
Instructor in Geology and Mining Engineering.	1912
HENRY PHILIP BRAEUTIGAM, B. S. in E. E.	412 E. Fourth St.
B. S. in E. E. 1909, Purdue	
Instructor in Mechanical and Electrical Engineering.	1912
HOWARD ARCHIBALD HUBBARD, A. M.	925 Tyndall Ave.
A. B. 1904, A. M. 1906, Ohio Wesleyan Univ.	
Instructor in Economics and History.	1912
ELSA CHAPIN, B. A.	724 E. Third St.
B. A. 1909, Wellesley	
Instructor in English and in Physical Training.	1912
MABEL AENELLA GUILD.	107 Olive Road
Assistant Librarian.	1907
RAYMOND L. QUIGLEY.	E. Fifth and Vine St.
Director of Athletics.	1912
ARTHUR LUDWIG ENGER.	109 Olive Road
B. S. 1911, Illinois	
Assistant Engineer, Experiment Station.	1912
CLIFFORD NORMAN CATLIN.	731 No. First Ave.
A. B. 1903, A. M. 1912, Nebraska	
Assistant Chemist, Experiment Station.	1912
HENRY CHENERY WHITE, A. B.	School for the Deaf
Principal of the School for the Deaf.	1912
HARRIET TUTTLE WHITE.	School for the Deaf
Instructor in the School for the Deaf.	1912
WARREN ARTHUR GROSSETTA, B. S.	113 E. Pennington St.
Assistant Commandant of Cadets.	1912
HARRIET ESTELLA BROWN, Ph. B.	422 So. Fifth Ave.
Instructor in Evening Class in Spanish.	1912
HELEN MARY ADELYNE MILLER.	University Campus
Librarian, Experiment Station.	1912

ADMINISTRATIVE OFFICERS

ARTHUR HERBERT WILDE, Ph. D., President.	Campus
ROBERT HUMPHREY FORBES, M. S., Director of the Experiment Station.	105 Olive Road
CHARLES ROSS STEWART, Business Manager.	1137 E. Seventh St.
ERNEST SUTHERLAND BATES, Ph. D., Secretary of the Faculty.	908 Speedway
NATHAN CESNA GRIMES, A. M., Registrar.	113 Olive Road
HERBERT BROWN, Curator of the Museum.	220 N. Court St.
JOHN ELVIN LOGAN, Superintendent of Grounds.	Campus
MRS. IDA TALCOTT UNDERHILL, Preceptress.	West Cottage
BERTHA MAUDE SANDERSON, Office Secretary.	207 E. Third St.
CARLOS CAMERON CABLE, Office Secretary, Experiment Station.	819 No. First Ave.
ARTHUR W. DUNSTAN, Bookkeeper.	1137 East Seventh St.

FACULTY COMMITTEES FOR THE YEAR 1912-13

COMMITTEE ON REGISTRATION

Professor Grimes, Chairman; Professors Waterbury, Turrell, Chandler, Miss Reid.

COMMITTEE ON CURRICULUM

Professor Chandler, Chairman; Professors Clothier, Henley, Goodrich, Perry.

COMMITTEE ON STUDENT ENTERPRISES

Professor Bates, Chairman; Professors Guild, Fowler, Mr. Quigley, Miss Reid.

COMMITTEE ON LIBRARY

Miss Lutrell, Chairman; Professors Waterbury, Bates, Brinton.

The University of Arizona was established by Act of Legislative Assembly in the year 1885, and opened to students in October, 1891.

The University is an integral part of the system of public education established by and for the State. Its general organization is in accordance with the Act of Congress of July 2, 1862, known as the Morrill Act, creating the "Land Grant Colleges." The details of its organization and government are regulated by the Act of the Legislative Assembly of the Territory of Arizona, passed in 1885, and embodied, with amendments, in the Revised Statutes of Arizona Territory, 1901, which vests the government of the institution in a corporation styled the Board of Regents of the University of Arizona, consisting of the Governor and Superintendent of Public Instruction of the State, ex-officio, and other members appointed by the Governor for a term of four years.

In creating the University, the Legislative Assembly wisely unified under one management the various schools and institutions of higher learning or investigation in Arizona,—the colleges of liberal arts, the schools of mining and engineering, the agricultural college, and the agricultural experiment station. No professional schools of law, medicine, dentistry, or music, and no normal department have been established. The University consists of

- I. The College of Liberal Arts, of Agriculture, of Engineering
—civil, electrical, mechanical, and mining.
- II. The Agricultural Experiment Station.
- III. The Preparatory or Sub-Collegiate Department.

The Sub-Collegiate Department will gradually disappear as the educational system of the State is developed by the establishment of efficient high schools; the first year of this work was discontinued in 1912-13; the second year will be discontinued after June, 1913.

The University in all departments is open to properly qualified persons of both sexes. Through the aid received from the United States and from the State, it is enabled to offer its privileges to residents and non-residents, with only very moderate charges. The number of students in any one class or section of a class is kept low, in order that each student may receive the individual attention of the instructors.

The purpose of the University of Arizona is, in the language of the organic law, "to provide the inhabitants of this Territory with the means of acquiring a thorough knowledge of the various branches of literature, science, and the arts," and so far as possible a technical education adapted to the development of the peculiar resources of Arizona.

In furtherance of this latter purpose, instruction is provided in the liberal arts and in subjects fundamental to agriculture, the mechanic arts, mining and metallurgy.

The University, by nature of its situation, is a great mining laboratory, surrounded on all sides by great mines. Some of these mines developed on a large scale are within a few miles of the city, and the number and magnitude of such enterprises are steadily increasing. The University offers exceptional advantages to the students of mining engineering who desire to see the actual operation of great mines, or the development of great enterprises, while carrying on the theoretical and experimental work of the mining course.

The advantages in civil engineering are hardly less noteworthy, for Tucson is not only a division point on the main lines of the Southern Pacific railroad and the El Paso and Southwestern railroad, with large shops, roundhouses, and engineering offices, but it has the administrative and engineering headquarters for five of the subsidiary or allied lines of the Southern Pacific system in Arizona and in Mexico, commonly known as the Randolph lines, including the great West Coast Line in Mexico. All of these lines furnish excellent opportunities for observation and vacation employment for students of civil engineering.

The University is also favorably situated for the study of agriculture. Tucson has many irrigated farms in its neighborhood, is near the great range country of southern Arizona, and occupies a central position with relation to the agricultural activities of the State. The University has kept pace with the growing interest and investment in agriculture in the State and has adapted its instruction and research in this science to the special needs of the State.

LOCATION AND CLIMATE

The University of Arizona is situated at Tucson, a city of eighteen thousand inhabitants, on the main lines of the Southern Pacific railway, and the El Paso and Southwestern (the Rock Island) System, 312 miles west of El Paso, Texas, and 500 miles east of Los Angeles, California. The city lies in a broad flat valley at an elevation of 2,400 feet above sea level and is surrounded by mountains. Its dry, mild, and equable climate has made Tucson a famous winter resort unsurpassed for healthfulness.

The winter climate is especially good; the temperature is cool and strengthening but seldom severe, the lowest temperature recorded during the average year being about twenty degrees above zero, Fahrenheit. Little rain falls during the winter; fogs are all but unknown;

cloudy days are rare. The percentage of sunshine throughout the winter is greater than that recorded at any other place in the United States. Owing to the extreme dryness of the air the highest temperatures known are less oppressive to the senses and less dangerous to the health than the summer heats of the upper Mississippi Valley states. The total amount of rainfall averages less than twelve inches.

These advantages insure to students a comfortable education and a wide range of out-door recreations throughout the college year.

The University Campus, consisting of sixty acres, is situated upon high ground about a mile from the business center of the city with which it is connected by an electric street-car line. On every side it commands a view of mountain scenery of remarkable extent and grandeur.

An abundant supply of unusually good water for household, laboratory, and irrigation purposes is drawn from a large well on the Campus from a depth of one hundred and twenty feet, thus securing immunity from the dangers of a contaminated water supply. The Campus has a complete sewer system connecting the buildings with the city mains at the University gate. The buildings are lighted by electricity.

The Campus, carefully laid out in drives, lawns, and gardens, with a large number of palms, olive, ash, umbrella, pepper, bagota, and cottonwood trees has the air of a well kept park.

BUILDINGS

The main building, University Hall, the oldest of the group, is 200 x 150 feet, two stories in height, the first of gray stone, the second of red brick. It is completely surrounded by a wide two-story veranda. The building contains recitation rooms, laboratories and apparatus rooms of various departments, an assembly room, and the office, laboratories and library of the Agricultural Experiment Station.

The Library and Museum building is a handsome structure of red brick and bedford sandstone, with a massive tile roof. The interior finish is in natural oak and pine. The library reading room, on the second floor, is a large, well-lighted room, furnished with heavy solid oak reading tables, desks and wall cases. The stack room at the rear is fitted up with modern steel racks. The Museum occupies the west half of the second floor. Fine oak and glass cases constitute the furnishings. The offices of the president and business manager of the University, a laboratory and a lecture room for the department of geology, and work rooms for the library are on the first floor.

Science Hall, a new building, of architecture harmonious with the Library, which it faces, was completed in April, 1909, at a cost of

about \$40,000. Further appropriation was made in March, 1909, for furnishing and equipping the building, which was thus made ready for occupancy in September, 1909. The building, 145 x 60 feet, is of three stories, the first devoted to physics, the second to chemistry and mineralogy, and the third to chemistry and biology. The roomy attic and a superstructure on the roof are used as an astronomical observatory.

North Hall, a dormitory, two stories in height, built of gray stone, of fine quality, is occupied by college men. Besides the parlor, and rooms of the instructor in charge, it contains sixteen rooms, each large enough to accommodate two students, besides bath and toilet rooms and sleeping porch.

South Hall, a large brick building containing thirty-five rooms, besides bath and toilet rooms and store rooms, is a dormitory for college men and for male preparatory students. It is heated by a hot water system. It will accommodate sixty-six students.

A new dormitory for men was completed in March, 1913, and furnishes accommodation for about forty students. The building is a model of construction, in brick and reinforced concrete, and in every way adapted to its purpose. The rooms are unusually large, with commodious closets. A sleeping roof provides sleeping accommodations in the open air for all the residents.

West Cottage and East Cottage are the dormitories for young women,—two story brick houses with wide porches, surrounded with vines, shrubbery, lawns and trees.

The Dining Hall, built of red brick, provides boarding accommodations for all persons living on the Campus.

The Shop and Assay building is a brick structure, containing a room for mechanical and freehand drawing, a large laboratory for forge work, machine practice and carpentry, and a lecture room, instrument room, and material testing laboratory for the department of civil engineering. Two other rooms are used for lockers, and for the motor and engine. The assay laboratory and commercial assaying department occupy five rooms fully equipped with a large melting furnace, the necessary muffle furnaces, and other accessories for making complete and accurate assays.

The Mill or Mining Machinery building, situated to the northeast of the main group of buildings, is a plain wooden structure fully equipped with stamp mills, jigs, concentrating tables, separators, and other machinery necessary for the mining laboratory.

Herring Hall, the gymnasium, is 40 x 80 feet in size, and is constructed of red brick and white plaster. It was erected in 1903, the

gift of Professor James Douglas and his associates of the Copper Queen Consolidated Mining Company, through Colonel William Herring, after whom it was named, at the suggestion of Professor Douglas.

The pump house and mechanical engineering laboratory was built in 1905. By use of brick, cement and iron it is practically fire proof, thus insuring safety to the well and pumps supplying the University with water for all its uses.

A two-story brick residence is occupied by the President of the University.

Other buildings are the cottage occupied by the Superintendent of Buildings and Grounds, three greenhouses, a brick barn, and various smaller outbuildings used for shops and store rooms.

MAINTENANCE

The University is maintained by funds appropriated by the United States and by the State of Arizona. Fifty-seven sections of very valuable pine land in Coconino county have been set apart by the Federal government for the benefit of the University, a small sum being annually received from the leases of this land.

By the provisions of the Morrill Act of 1890, the University receives annually from the United States the sum of \$25,000 "to be applied only to instruction in agriculture, the mechanic arts, the English language and the various branches of mathematical, physical, natural and economic science, with special reference to their applications in the industries of life, and to the facilities for such instruction." This Morrill Fund is duplicated by the Nelson Fund, created by the Act of March 4, 1907, which appropriated \$5,000 for the year beginning July 1, 1907, and provided for an annual increase of \$5,000 until the total received by each state should be \$50,000 a year from the two funds. The University receives from the same source, for the support of the Agricultural Experiment Station, \$15,000 yearly from the Hatch Act of 1887; the Adams Act of 1906 for the current year yields \$15,000, giving the Station \$30,000 a year.

The appropriations of the Legislature for the year 1912-13 were \$48,680 for maintenance; \$23,320 for improvements, and \$18,000 for the work of the Agricultural Experiment Station.

The endowment of \$5,000 granted in 1911 by the El Paso and Southwestern Railroad for the use of the Agricultural Experiment Station in carrying on hydrographic work in Sulphur Springs Valley still affords means for continuing these studies, in cooperation with property owners of the Valley.

The University also receives annually, from miscellaneous sources such as matriculation and tuition fees, etc., about \$1,500. The receipts for board, light, etc., amount to about \$18,000 per year.

ENDOWMENT

By the munificence of Doctor James Douglas, of New York, the University received in June, 1908, "the sum of \$10,000 * * * the annual interest or income from which is to be annually applied, devoted, expended and used by said Board of Regents, or its successors in trust, for the purchase of instruments of precision and research, or special apparatus, for scientific instruction and education in the department of mineralogy and School of Mines of the University of Arizona, * * * but no part of said fund or income is to be used or applied to the purchase of mining or metallurgical machinery or supplies for such department or for the use of students in the chemical or metallurgical laboratories." The fund thus created has been named by the Board the Douglas Endowment Fund.

LIBRARY

The building contains 20,000 bound volumes and several thousand unbound bulletins and reports, chiefly agricultural. The present appropriations provide for an annual increase of about 1,500 volumes. Since, of the total accessions nearly one-half has been made within the last five years the books, as a whole, have a direct bearing upon the college work now offered. Of these volumes a collection of complete sets of certain scientific and literary periodicals, to which additions are made yearly, is of special service to those interested in research. The library was made a regular depository of United States Government documents in 1907. These publications have been placed in a separate room where they are arranged by departments. The library has recently added to its catalogue the U. S. card indexes issued by the Department of Agriculture. Much of the early material therein indexed has been received through private donations and the later numbers secured by application, thus making the sets very satisfactory for use in reference work.

The books are classed by the decimal system and shelved in numerical order with a further author division according to the Cutter numbers. The catalogue is the usual dictionary card catalogue of authors, subjects and titles in one alphabetical arrangement. Printed cards from the Library of Congress are used, supplemented by typewritten cards for books reported as not in their stock.

The Reading Room is supplied with about 600 books of general reference which may be consulted by the students without any formal-

ity. All books with the exception of periodicals and books reserved for reference may be drawn for home use. The use of the books and of the periodicals within the building is free to all persons. Upon application to the Library Committee as liberal privileges, for the withdrawal of books, as are possible will be extended to those outside who are engaged in systematic study. The following is a partial list of serials and newspapers on file for the use of students.

LIST OF SERIALS

- *Advocate of Peace,
American Architect and Building News,
American Association for the Advancement of Science, Proceedings,
American Blacksmith,
American Breeders' Association, Proceedings,
American Chemical Journal,
American Chem. Society Journal,
*American Economist,
American Electro-Chemical Society, Transactions,
American Forestry,
American Geographical Society, Bulletin,
American Historical Review,
American Institute of Mining Engineers, Transactions,
American Journal of Pharmacy,
American Journal of Science,
American Journal of Sociology,
American Labor Legislation Review,
American Library Association Booklist,
American Machinist,
American Magazine,
American Mathematical Society, Bulletin,
American Mathematical Society, Transactions,
American Naturalist,
*American Philosophical Society, Proceedings,
American Political Science Review,
American Society for Testing Materials, Proceedings,
American Society of Civil Engineers, Transactions,
Annalen der Physik,
Annales des Mines,
Architectural Record,
Archiv f. d. Studium d. neueren Sprachen,
Association of Engineering Societies, Journal,
Astrophysical Journal,
Athenaeum,
Atlantic Monthly,
Australian Mining Standard,
Biblot,
Biedermann's Zentralblatt fur Agrirkulturchemie,
Blanco y Negro,
Book Review Digest,
*Bookbuyer,
Bookman,
Botanical Gazette,
Breeder's Gazette,
Bulletin of Bibliography,
*California Cultivator,
*California University Publications,
Canadian Entomologist,
Canadian Mining Journal,
Cassier's Magazine,
Cement,
Centralblatt f. Mineralogie,
Century,
Chemical Abstracts,
Chemical, Metallurgical and Mining Society of South Africa, Journal,
Chemical News,
Chemical Society, Journal, (London),
Chemisches Centralblatt,
Collier's Weekly,
Country Gentleman,
Country Life in America,
Craftsman,
Cumulative Book Index,
Current Opinion,
Deutsche Chemische Gesellschaft, Berichte,
Dial,
Economic Geology,

- Educational Review,
Electrical Review,
Electrical World,
Engineering and Mining Journal,
Engineering Index,
Engineering Magazine,
Engineering News,
Engineering Record,
Englische Studien,
English Historical Review,
Espana moderna, La.,
*Farmer's Voice,
Fortnightly,
Franklin Institute, Journal,
Geological Magazine,
Geological Society of America,
 Bulletin
Geologisches Centralblatt,
Graphic,
Harper's Monthly Magazine,
Harper's Weekly,
Havana University, Revista de la
 Facultad de letras y ciencias,
L'Illustration,
Independent (N. Y.),
Institut de France, Paris, Acadé-
 mie des Sciences, Comptes ren-
 dus des Séances,
International,
International Labor Office, Bulle-
 tin,
International Studio,
Irrigation Age,
Journal of American Folk-lore,
Journal of English and Germanic
 Philology,
Journal of Geography,
Journal of Geology,
Journal of Morphology,
Journal of Political Economy,
Ladies' Home Journal,
Library Journal,
Life,
Literary Digest,
Living Age,
*Lowell Observatory, Bulletin,
McClure's Magazine,
Machinery,
Manual Training Magazine,
Metallurgical and Chemical Engi-
 neering,
Mexican Mining Journal,
Mineral Industry,
Mineralogical Magazine,
Mines and Methods,
Mines and Minerals,
Mining and Scientific Press,
Mining Magazine (London),
*Mining Reporter,
*Mining Review,
Mining Science,
*Mining World,
Missouri Ruralist,
Modern Language Association of
 America, Publications,
Modern Philology,
Monist,
Moody's Magazine,
Muhlenbergia,
Musician,
Nation,
National Geographic Magazine,
National Municipal Review,
Nature,
Neues Jahrbuch f. Mineralogie,
New York Dramatic Mirror,
Nineteenth Century and After,
North American Review,
*North German Lloyd Bulletin,
*Our Dumb Animals,
Out West,
Outing,
Outlook,
Philosophical Magazine,
Philosophical Review,
Physical Review,
*Plant World,
Poet-Lore,
Political Science Quarterly,
Popular Astronomy,
Popular Science Monthly,
Por Esos Mundos,
Power,
Practical Engineer,
*Prairie Farmer,
Public Libraries,
Publishers' Weekly,
Quarterly Journal of Economics,
Queensland Government Mining
 Journal,
Readers' Guide to Periodical Lit-
 erature,
Review of Reviews,
Revue des deux Mondes,
St. Louis Mirror,
School of Mines Quarterly,
School Review,
Science,
Scientific American,
Scientific American Supplement,
Scribner's Magazine,

Seismological Society of America,
 Bulletin,
Societe francaise de Mineralogie,
 Bulletin,
Society for the Promotion of Engineering Education, Proceedings,
Society of Chemical Industry,
 Journal,
South African Mining Journal,
Spectator (London),
Sunset,
Survey,

System,
Technical World,
Torrey Botanical Club, Bulletin,
World's Work,
Zeitschrift f. analytische Chemie,
Zeitschrift f. anorganische
 Chemie,
Zeitschrift f. Elektrochemie,
Zeitschrift f. Krystallographie,
Zeitschrift f. physikalische
 Chemie,
Zeitschrift f. praktische Geologie.

NEWSPAPERS ON FILE IN THE READING ROOM

*Arizona Blade,
*Arizona Bulletin,
*Arizona Daily Star,
Arizona Range News,
Arizona Republican,
*Arizona Silver Belt,
Arizona Weekly Journal-Miner,
Bisbee Review,
Boston Transcript,
*Copper Era,
Douglas International,

*Donated.

*Graham County Guardian,
Los Angeles Times,
Mojave County Miner,
New York Times (Saturday ed.),
*Oasis,
Prescott Weekly Courier,
Southwestern Stockmen,
*Tempe News,
Tucson Citizen,
Tucson Post,
Tombstone Epitaph,
*Yuma Sun.

The Carnegie Library of the City of Tucson is also open to the use of the students of the University. This library also is a depository of United States Government documents.

MUSEUM

The professors of the University have the immediate care of the collections pertaining to their respective departments. The collections now displayed at the University comprise representative series of minerals, ores and rocks of Arizona. Among these may be particularly mentioned superb specimens from the mines of the Copper Queen Mining Company at Bisbee. There are also collections of typical rocks and materials for comparison, and many specimens of ores from different parts of the United States and from abroad. It is desired to make the collection of ores and minerals fully represent the great mineral resources of Arizona.

The Museum is indebted to Mr. Herbert Brown, curator, for a large and valuable collection of skins of the birds of Arizona, which he has deposited in the Museum, as well as for a collection of ancient aboriginal pottery and other relics. The fossil skull and teeth of an elephant, and other fragmentary remains of extinct animals, sent from Yuma by Mr. Brown, deserve special mention.

The Museum has been made the custodian of a rare collection of arms and military relics, chiefly from the Philippine Islands, deposited by Captain Charles C. Smith, of Fort Huachuca, Arizona.

Historical records of much value are gradually accumulating as a part of this museum, and an appeal is made to old settlers and others to bear this fact in mind when making disposition of articles bearing even remote relation to the early pioneers and their history. All records and data of any nature that can be gleaned are worthy of preservation, and it is earnestly desired to have them placed at the University, where they will always be accessible for reference.

AGRICULTURE AND HORTICULTURE

The University demonstration farm consists of eighty acres of Rillito Valley land. Thirty-five acres of this have been cleared; twenty acres are seeded to alfalfa. Additional acres will be used for garden crops during the summer of 1913, and the leveling and irrigation of other areas will add to the resources of the farm. An excellent well furnishes water for the farm, a number five Krogh pump being run by a twelve horse power gasoline engine.

A farm residence has been constructed at a cost of about \$2,000, which is occupied by the farm foreman and his family. It contains a small office for safekeeping of farm records.

The farm has recently constructed a horse barn with room for five horses and a work shop at a cost of about \$900; a modern sanitary dairy barn designed to furnish accommodations for 40 cows, at a cost of about \$1,600; a water tank with a capacity of 6000 gallons and a distributing system for the whole ranch, at a cost of \$500. The main distributing ditch for irrigation purposes has been constructed out of cement tile at a cost of \$1100, an improvement that will soon pay for itself in the saving of water otherwise lost by percolation and evaporation.

During the summer of 1911 a dairy herd of pure bred animals was purchased and also a full equipment for laboratory and farm dairy work.

The agronomy laboratory is well equipped with apparatus for teaching soil physics; green houses furnish accommodations for laboratory work in plant culture and other horticultural subjects. Laboratory facilities are being provided for the use of classes in animal physiology. It is intended to provide full equipment for laboratory and demonstration work in poultry husbandry in the coming year.

The agricultural section of the University library contains leading reference works in agriculture, including cyclopaedias, herd books,

standard texts, and experiment station bulletins. The student is required to make much of his preparation for class by consulting the works in the library.

The laboratories of the Agricultural Experiment Station, together with its plant breeding and plant introduction gardens, located on the University campus, furnish abundant opportunity for students to observe the working out of experimental problems of vital interest to the agriculture of the State. The campus itself, with its many ornamental trees, shrubs, and flowers, all of which are peculiarly adapted to the climate of the arid Southwest, furnish excellent facilities for the study of problems of ornamentation and home building.

In addition to regular courses of instruction in agriculture and horticulture, "Timely Hints for Farmers," issued under the auspices of the Experiment Station, are of distinct educational value. Five thousand farmers of the State are reached more or less regularly by publications on subjects of vital interest. Farmers' Institutes, announcements of which are made from time to time, are supplemented by short courses in agriculture. The first Demonstration Train has been operated in the current year by the University in cooperation with the Santa Fe, Southern Pacific, and El Paso and Southwestern lines.

Small and well selected agricultural libraries of small cost have been forwarded to a considerable number who have expressed a willingness to receive them.

ASTRONOMY

The atmosphere of southern Arizona is perhaps the best in the United States for astronomical observation, having smaller percentage of cloud and less average wind velocity than any other locality where records have been preserved. The dry air and 2400 feet elevation give Tucson such a clear sky that faint stars may be watched till they set behind the distant horizon; the fine weather, day after day, gives opportunity for consecutiveness of observation not obtainable elsewhere; a greater portion of the year is available, with less interference from air currents.

The course in astronomy is arranged especially to draw attention to these advantages, and, at the same time, to give that understanding of the motions of the earth and planets which is important in many branches of engineering. The eight-inch Harvard telescope with its Clark glass and the four and one-fourth inch Brashear telescope of the University will always be available for closer study of the heavenly bodies. Two excellent clocks with electric connections for transmit-

ting time give opportunity for longitude, latitude and time observations.

BIOLOGY

The biological laboratories are located in a suite of eight rooms, convenient and well-lighted, on the third floor of Science Hall; the equipment is suited to modern instruction and research in the biological sciences. The library and apparatus are well selected and adapted to the region and to the courses offered.

The herbarium consists of 40,000 mounted specimens, of which 15,000 sheets are in the Arizona botanical survey collection. There are also 4,000 sheets in the herbarium of cultivated plants. The building up of these collections is progressing rapidly, largely by virtue of the work on the botanical survey of the State, which is being conducted by the department of biology, and which will result ultimately in the publication of a Flora of Arizona. The unique flora and fauna of the mountains, foothills, mesa and river valley collecting grounds, in close proximity to the institution, offer attractive opportunities for instruction and research, particularly along taxonomic and ecological lines.

In addition to the above, there are articulate and inarticulate skeletons, plaster and papier mache models of the more important structures of the human anatomy, and duplicate material for study and dissection. The department has 28 compound microscopes of the latest Spencer, Bausch and Lomb, and Leitz types, which number is being added to each year. Recently several pieces of special apparatus have been purchased, among which are a Leitz rotary microtome, a large paraffin bath, a McIntosh stereopticon, and a new photographic camera. About \$400 also was invested in new plant physiology apparatus.

The Desert Botanical Laboratory of the Carnegie Institution supplements in admirable manner the facilities of the University for botanical investigation, particularly as concerns field plant physiology and plant geography.

CHEMISTRY

The chemical laboratories used for instruction occupy twelve laboratories, class rooms, and storerooms, on the second and third floors of Science Hall.

The laboratory used by Freshmen for the study of general chemistry and qualitative analysis is at the east end of the second floor of Science Hall. It was newly furnished throughout during the year 1910-11, with desks, hoods, and racks, and piped for both water and gas. It has accommodations for forty-eight students.

The laboratory for quantitative analysis is at the west end of the second floor of Science Hall. It is thoroughly equipped for the teaching of volumetric and gasometric analysis, and metallurgical chemistry, including apparatus for the electrolytic determination of metals. The balance room contains analytical balances of the latest models so arranged as to insure a maximum of stability and accuracy.

METALLURGY

A lecture and demonstration room fitted with sinks and cabinets completes an equipment of apparatus and collections adequate for comprehensive instruction in both theoretical and practical chemistry.

The laboratory of physical chemistry, on the third floor of Science Hall, has the following apparatus: Wanner's Optical pyrometer, Châteliers pyrometer, boiling point and freezing point apparatus, Pulfrich refractometer, large wave length spectroscope made by Adam Hilger, London, thermostats, polariscope, and apparatus for conductivity work and the determination of electro-motive force.

A small laboratory on the third floor is fully equipped for electro-analysis, and another for organic chemistry and gas analysis.

The laboratories of the Agricultural Experiment Station occupy four rooms on the first floor of the Main Building. These are devoted to analytical work and to chemical investigations relating to agriculture. Though not intended for the use of students, they are of incidental value to the instructors and students through the investigations which are here conducted.

CIVIL ENGINEERING

The present quarters of this department are a recitation room, an instrument room and office, a materials testing laboratory, and a drafting room. The recitation and drafting rooms occupy the entire east end of the third floor of Science Hall. The materials testing laboratory is in the Shop and Assay Building.

The instrument room contains lockers in which the surveying instruments are kept. These include six transits, four levels, two plane tables, two compasses, a sextant, a considerable number of small instruments, and other equipment required for field work.

The materials testing laboratory is fitted for making physical tests of wood, iron, steel, stone, cement, concrete, and other materials used in engineering construction. The apparatus includes an Olsen 100,000 pound universal testing machine, a duplex micrometer extensometer, a Fairbanks cement testing machine, briquette molds, cube molds, molds for concrete beams, molds for specimens for testing shearing strength of concrete, a Vicat needle machine, specific gravity flasks, sieves, a moist chamber and other auxiliary equipment.

GEOLOGY

The department of Geology occupies two rooms in the Library building, one laboratory and drawing room and the other a lecture room. The laboratory has the usual drawing tables and five Loughlin Hough drawing boards, besides the necessary drawing instruments and special appliances for geological mapping. A complete set of geological and lithological specimens and geological models of various parts of the United States are used for illustration and study. For field surveying in geology, the University has an Izard Warren light mountain transit, a Bausch and Lomb alidade with plane tables, Zeiss telometer, one Aloe barometer, two Zeiss field microscopes, one Nachet microscope, one Gurley pocket transit, one Verschoyle patent transit, one Aloe pocket alidade, one Aloe pocket level, one Keufel and Esser liner, one Bausch and Lomb pocket transit, one Coradi planimeter, one Aloe section liner, one Short and Mason and one Casetta barometer, slide rules, complete camping outfit and necessary carrying sacks for all instruments and outfit.

MECHANIC ARTS

The Shops and Drawing Room occupy a total floor area of about 8000 square feet, divided into a large shop and machinery room, with adjacent tool, supply and store rooms; draughting, model, pattern, and lecture rooms, and office.

The entire building is well ventilated and lighted from above as well as from the sides and is steam heated.

The wood shop has a full assortment of hand tools, twenty-four benches with a complete set of tools for each, six turning lathes, Beach scroll saw, a Whitney dimension sawing machine, a band saw, a Universal trimmer, and a large grindstone with truing device.

The forge-room contains twenty down-draught forges, twenty anvils, a combination shear and punch, a blacksmith's drill press and a full assortment of small tools and appliances. Blast is furnished by a No. 3 Sturtevant blower; smoke and gases are removed by a 70-inch exhaust fan.

The machine shop contains one 24-inch Lodge and Shipley engine lathe with taper attachment, two 14-inch Lodge and Shipley lathes, one 14-inch Pratt and Whitney lathe with taper attachment, one 12-inch Seneca Falls lathe with taper attachment, draw-in chuck, and English and Metric change gears; one 10-inch Reed speed lathe, one 16-inch Cincinnati shaper, one 24-inch by 6-foot Woodward and Powel planer, one Browne & Sharpe No. 2 Universal milling machine, one Browne & Sharpe No. 1 Universal grinder, one Prentice 24-inch drill press, one 13-inch slate sensitive drill, one power hack

saw, one drill grinder, one emery stand, one grinding attachment for lathes, one $1\frac{1}{2}$ ton portable hoist, one 1-ton triplex hoist, one $\frac{1}{2}$ -ton screw hoist. Each shop has its own tool room with small tools, gauges, and measuring instruments.

MECHANICAL AND ELECTRICAL ENGINEERING

The department possesses a comprehensive catalogue file containing the trade literature of about five hundred leading manufacturers of this country, together with a large collection of working drawings, and sample collection of models, machine parts, valves, electrical fittings, insulating materials, and abrasives.

The mechanical and electrical laboratory is equipped for experimental work in the study and operation of steam boilers, steam and gas engines, hydraulic and electrical machinery. Besides the machinery of the shop and mill which may be used for the study of machine design as well as for experimental work, the University has a 45 horsepower return tubular boiler, a 35 horsepower Atlas center crank engine, a 60 horsepower Chuse high speed automatic side crank engine, to be direct connected to generator, a 30 horsepower Fort Scott engine, a $10 \times 7 \times 10$ Worthington duplex direct acting steam pump, a small duplex pump, a small Cameron boiler feed pump, an injector, a 40 horsepower Fairbanks Morse gasoline engine directly connected to a 500 gallon high pressure fire pump, a 23 k. w. Crocker Wheeler direct current generator, a 5 k. w. Fort Wayne rotary convertor, a 15 horsepower Wagner variable speed induction motor, a 7 horsepower Westinghouse induction motor, a 7 k. w. Westinghouse direct current generator, direct connected to a four-cylinder gasoline engine, a 3 horsepower and a $\frac{1}{2}$ horsepower direct current motor, a 5 k. w. Packard variable voltage transformer, two small testing transformers, and, for measuring instruments, two graphic recording volt meters and ammeters, several integrating watt meters, and a series of indicating meters. An $8'' \times 10''$ Gould triplex pump with its electric motor serves as part of the equipment of the mechanical-electrical laboratory and furnishes the University with its water supply. The department is well equipped with steam indicators, gauges, and weighing scales. For the testing of pumping machinery a large steel wier box overflowing into cement cistern is connected by suitable piping to the various pumps in the laboratory.

METALLURGY

The Mill or metallurgical laboratory tests the adaptability of ores for treatment by different processes both on a large and small scale.

The chief features of the equipment are a Blake crusher, 4 in. by 7 in.; a Dodge crusher, 4 in. by 6 in.; sampling rolls, 6 in. by 9 in.;

a cone and burr sample grinder; a pebble mill with a capacity of about 15 lbs. at one charge; a laboratory lightning crusher and a disc pulverizer; a 5-stamp mill, with 800-pound stamps; a 3-stamp mill, with 250-pound stamps; inside and outside amalgamation plates for the same; a 2-ft. clean-up pan; a 1-ft. amalgamation pan, and a 9-jar revolving agitator for testing samples of a few ounces; a No. 5 Wilfley table of the latest pattern, and a Hallett hand jig; a 1½ ton cyanide plant for treating sands or dry crushed ore; two 150-lb. cyanide plants for treating smaller samples; 3-ft. agitator; a 12-in., 6-chamber, flush plate and frame, washing filter press and pump for the same; a Sturtevant shaking screen; a Tullock ore feeder; a belt and bucket elevator, sampling plates, split samplers, a shaking screen, percolators, sizing screens from 1-mesh to 200-mesh, miners' pans, bateas, retorts, etc.

The power for operating this plant is furnished by a 30 h. p. Westinghouse induction motor, type C.

The Callow Miniature Plant has been recently added, consisting of: 1 small two-compartment Harz jig, 1 small Wilfley table, 1 canvas slime table, 1 amalgamating plate, 1 set hydraulic classifiers, 1 set cyanide agitators, 1 automatic feeder. This plant is driven by a $\frac{1}{8}$ h. p. motor and stands on a hopper bottom tank divided into three compartments. It is a complete ore dressing plant, gold mill—and together with the cyanide percolators described elsewhere—cyanide mill, and tests quantities of ore ranging in amounts from 25 to 400 pounds. The results from these tests should predict the performance of a full size plant. Also 1 Richards' pulsator jig and 1 Richards' pulsator classifier.

An International dry concentrator has just been presented to the University.

The assay laboratory is equipped with assay furnaces for crucible work, for scorifying and cupeling, and for retorting mercury from amalgam, fired with coke, gasoline, and gas, so the student becomes trained in the use of all these fuels. There are besides, all needed appliances for assaying by dry and wet methods including electrolysis. The laboratory has desks and fittings for the chemical work required in the metallurgical and mineralogical investigation and analysis of ores, in mineral fertilizers, and in qualitative tests of minerals.

MINERALOGY AND PETROGRAPHY

The laboratories for mineralogy consist of two rooms on the second floor of Science Hall, one being used for microscopic work in petrography and the other for blowpipe analysis and determinative mineralogy. The laboratory for microscopic work contains seven petrographic microscopes including both American and foreign make, one

Zeiss binocular for opaque work, models for illustrating axes of elasticity and spherical projection, a type set of rocks classified according to Rosenbusch's *Elemente der Gesteinlehre* with thin section corresponding, 120 oriented sections of minerals, and apparatus for photomicrography and projection. The laboratory for blowpipe analysis is well supplied with minerals for making the necessary tests and studying the physical properties. A type set of 600 minerals classified according to Dana is included. For the study of crystallography, there are a collection of 300 pasteboard models of crystals, numerous glass and wooden models, three two-circle contact goniometers and one two-circle reflecting Goldschmidt goniometer of the most recent type, apparatus for projection and drawing of crystals, and a model machine for cutting crystals from plaster of Paris.

MINING

The laboratory for practical mining is now being fitted up, principally by donations of equipment from the various manufacturers of mining machinery. The donations up to the present time have included drills of various types, pumps, hose, crushing machinery, pulleys, blowers, etc., and it is expected within a short time to have a very complete laboratory for the teaching of practical mining. Models are also being constructed which will illustrate in minute detail various branches and conditions of mining and will demonstrate methods of construction. These will include various types of head frames, mill buildings, underground timbering, ore bins, and other structures.

PHYSICS AND ASTRONOMY

The department of physics occupies the entire first floor of Science Hall, where facilities for the demonstration of all important phenomena are complete. A lecture room seating forty persons is fitted with modern conveniences, such as lights, water, gas, heliostat, alternating and direct currents of great range, an opaque projection lantern, elevated seats, and shutters for darkening the room. Two large main laboratory rooms supply space for mechanical and electrical work, while special rooms are devoted to heat, sound, light, magnetism and research work. A carpenter's shop, a repair and store room, a photographic dark and enlarging room, and a constant temperature room are provided. A pendulum seismograph is installed in the magnetic laboratory and a special space has been provided for a 55-foot Foucault pendulum and the study of falling bodies.

An eight-inch Willyoung induction coil with storage and X-ray accessories is used in the study of high-tension electricity. There are also a large Oudin resonator and a mercury interrupter, manufactured

by Cox, and a Tesla coil of the Elster and Geitel type. Through the generosity of the Hon. Mark J. Egan, of Clifton, the University has a fine imported set of miniature wireless telegraphy apparatus, capable of transmitting messages about two hundred feet. A Knott wireless outfit of $\frac{1}{4}$ -kilowatt power, capable of sending messages about twenty-five miles, is installed. The department possesses, also, three motor generator sets, the largest having an output of 7-kilowatts, a Leeds and Northrup potentiometer and accessories, and very complete apparatus for showing electro-magnetic phenomena, rotary fields, and stationary electric waves.

The astronomical observatory is at the top of the building where a sliding roof, 12 feet square, uncovers the telescope and discloses a clear horizon in every direction. An 8-inch Clark lens and mounting, both of the first quality, loaned to the University by the Observatory of Harvard University, Cambridge, Mass., are mounted on a cement pier supported on the main walls of the building, and give perfectly steady images. This lens is most efficient in fundamental research work. The equipment also includes a four and one-quarter inch Brashear telescope, sidereal and mean time clocks, and pier for latitude and longitude observation.

GYMNASIUM

Herring Hall, the gymnasium, is well supplied with apparatus of standard make, which includes forty chestweights, dumb-bells, bar-bells, wands, Indian clubs, Medart vaulting horse, parallel bars, horizontal bar, quarter-circle, abdominal chair, wrestling machine, finger machine, chest expander, chest developer, climbing rope, flying rings, traveling rings, striking bag and drum, jumping and vaulting stands, fencing foils and masks, basket balls and goals, five large mats and a set of anthropometric apparatus.

In the basement are one hundred and forty-four lockers, and five shower baths supplied with hot water from a heater with large reservoir.

The outdoor equipment consists of two baseball fields; a football field, six-lap track, and straightaway; five fine tennis courts; and a basketball court for girls.

MILITARY

A room in the basement of University Hall is used as an armory and is fitted up with the necessary gun racks and accessories. The equipment includes 150 old style Springfield rifles, 100 Krag cadet rifles with complete accoutrements, 4 model 1906 Springfield chambered for .22 for indoor practice, eight sabres and belts, musical instruments for the band, signal flags, and targets for short range practice.

Fifteen 10 x 12 army wall tents with poles, and a mess outfit, constitute the camp equipment of the department of military science and tactics for use on practice marches and annual encampments.

REGISTRATION

All students are expected to register on registration days at the beginning of the year and at the beginning of the second semester, in the University office or in such rooms as may be designated for the purpose. Before making choice of elective subjects the student should in every case confer with the instructors concerned and with the Registrar. All students are required to pay an incidental fee of \$10.00 at the time of registration, and no student will be considered registered and entitled to attend classes unless this fee has been paid. After registration no change in classes may be made without the consent of the President or the Registrar.

After the first week of the student's attendance upon the University, his registration will be regarded as fixed and requests for change will be granted only under unusual circumstances.

No student will be permitted to take more than 18 units of work except upon petition granted by the Committee on Registration, and such petitions will not be accepted from students just entering upon their first semester in the University.

Ordinarily students are expected to continue into the second semester the courses taken in the first. A registration day is set at the end of the first semester for such revision of work in the second semester as may be advisable.

Students entering from other institutions should present to the Registrar certified copies of their records in such schools, together with certificates of graduation or of honorable dismissal. A copy of the school catalogue or course of study should be furnished with the credentials, in order to facilitate registration.

RECORDS

The class standing of each student is determined by the instructor in charge. The method of ascertaining the student's record is left to the instructor, and his report in all cases is final. In addition to the reports at the end of each semester, which form the permanent records of each student, each instructor makes a monthly provisional report to the office on all students registered in his courses.

DISCIPLINE

The disciplinary policy of the University in all its departments is based upon the assumption that students come to the institution with a high determination to utilize fully the opportunities offered, and with

a keen sense of duty, honor and courtesy to each other and to the faculty.

Students or classes desiring to make requests of the faculty should file their petition in the President's office before the hour of faculty meeting; class petitions must be presented at least two days before the time of meeting.

LIVING ACCOMMODATIONS

Provision is made so far as possible for furnishing board and rooms to students of both sexes upon the University grounds. Young men have comfortable quarters in South Hall, accommodating about sixty-five students, two in a room; in North Hall (for College men only), accommodating thirty-two students; and in the new Dormitory, accommodating forty students. East and West Cottages provide accommodations for young women, under the direction of a capable and experienced preceptress.

All dormitories are lighted by electricity. Rooms contain a clothes press, and are provided with single bedstead, tables, chairs, mirror, wash bowl, and pitcher. Students will supply their own mattresses, pillows, sheets, blankets, towels, rugs, and brooms, laundry bags, and such other articles as they may desire for ornamenting their rooms. They will care for their own rooms under the direction of the head of each dormitory.

The Dining Hall of the University is under the management of a paid steward who is responsible to the President and the Board of Regents. While the charge of \$20 per month for board is low, it is the aim of the management to serve substantial, wholesome, appetizing meals. All students having rooms in the dormitories are required to take their meals at the Dining Hall. Students and members of the faculty who reside outside of the dormitories may board at the Dining Hall.

By resolution of the Board of Regents of the University, board is to be paid in advance on the twelfth of each month. If payment is not made before the fifteenth of each month, \$21.00 instead of \$20.00 will be charged for the month's board. Checks and postoffice or express money orders should be made payable to the University of Arizona. No reduction in the bill for board will be made for a period less than one week, except by special arrangement at the office, made in advance.

TUITION

Tuition is free to students of Arizona. For all non-resident students, tuition is \$15 for each semester. No reduction will be made for late registration or early withdrawal.

FEES AND EXPENSES

	LOW	HIGH
Tuition free to students from Arizona.....		
Tuition, students non-residents of Arizona, each semester	\$15.00	\$15.00
Incidental fee, paid annually.....	10.00	10.00
Mining excursions for advanced students.....	20.00	40.00
Military uniforms, one cadet gray, one khaki.....	21.00	21.00
Books, a year.....	5.00	20.00
Board, a month.....	20.00	20.00
Dormitory fee, annual.....	25.00	25.00

LABORATORY FEES

Assaying. See Metallurgy 2.

Botany, 1, 2, 3, 4, each.....	\$ 2.50
Chemistry 1, 2, 3, 4, 5, 6, 7, each.....	12.00
Chemistry 10.....	5.00
Chemistry III (Preparatory year).....	12.00
Civil Engineering 3, 11, 13, 14a, 14b, 15, 17, 18, 20, 22, each.	1.00
Civil Engineering 1, 2, 6, 7, 8, 9, 10, 19, each.....	1.50
Civil Engineering 14.....	2.00
Geology 5, 6 (year).....	10.00
Mechanic Arts I, II, 1, 2 (each year).....	1.00
Mechanic Arts—Shop courses each semester unit.....	1.50
Mechanical and Electrical Engineering, drawing, a year.....	1.00
Mechanical and Electrical Engineering, laboratory, semester..	3.00
Metallurgy 2, (Assaying).....	25.00
Metallurgy 5a, 5b, 6, each.....	10.00
Mineralogy 1.....	12.00
Mineralogy 5, 6 (year).....	5.00
Physics 1, 2, (year), IV (year).....	2.00
Physics 3, 4, 5.....	2.00

Text-books may be obtained through a campus book store managed under the direction of the University.

Members of the cadet companies will be required to provide themselves with the prescribed uniform, which will be ordered by the University. The uniform has shown better wearing qualities than a civilian suit of equal cost; it may be worn on all occasions, and thus will remove the necessity for additional expenditure for outer clothing other than overcoats. When the warm weather of spring comes, the students are expected to purchase the regulation khaki uniform and campaign hat. The total expense of both uniforms is about \$21.00.

ASSISTANCE TO STUDENTS

Various positions about the grounds, buildings and laboratories of the University, paying from \$4 to \$20 per month, are filled by students who must be self-supporting. The number, however, is not large, and preference is given to students from Arizona and to those who have spent time enough in the University to demonstrate that they are earnest, capable, reliable young men, able to do this outside work and at the same time maintain a good record as students.

The Students' Loan Fund, now amounting to \$630, gives temporary assistance to deserving students, men or women. The conditions under which loans are made may be ascertained on inquiry of the President of the University.

County Scholarships—By act of the legislature of 1912 a scholarship in the University was granted to each county of the state, to be assigned to that student who passed the best examination set by the University. The examination is under the direction of the County School Superintendent and is held early in the month of June. The papers are referred to the University for reading and the President certifies the results to the County Superintendent and to the successful candidate.

Candidates for county scholarships are examined upon the following subjects: English, algebra, science (either agriculture, botany, zoology, physics, chemistry, or physical geography); and two other subjects (chosen from history, Latin, French, German, Spanish, or a second science). The examination is restricted to five subjects.

The scholarship amounts to \$150 a year and is payable by the State direct to the University, to be applied on the student's bills for board, room, incidental, and other fees. (The full amount of these fees may be found by referring to the index of this volume under "Expenses".)

The scholarship is good for one year at the University and is to be held only during the student's Freshman year, except that when a given county has no other representative in the University a candidate for admission to a higher class in the institution may apply for the qualifying examination and if successful, secure the scholarship.

The Tucson Women's Club Scholarship—The Tucson Women's Club has given a scholarship during the year, to be assigned at the discretion of the President of the University to some young woman who has especially distinguished herself for excellence in scholarship. Its value is \$50.

The Bennett Scholarship—The Philo Sherman Bennett scholarship is endowed by the gift of \$500 to the University in 1905, through the

agency of Mrs. William Jennings Bryan, the income to be used in aiding young women to secure an education.

REQUIREMENTS FOR ADMISSION

Applicants for admission to any department of the University will be required to furnish satisfactory evidence of good moral character, and certificate of graduation or of honorable dismissal from the schools with which they were last connected.

For admission to the Freshman class applicants must be at least sixteen years of age and must satisfy requirements in subjects sufficient to give fifteen credits as described below. A credit is understood to be the equivalent of one study pursued satisfactorily five times a week for one year, as ordinarily taught in high school.

Students coming from approved high schools and preparatory schools, and presenting from the principals of such schools a detailed official statement of work completed, will be excused by the committee on registration from entrance examination in those subjects. Other students will be required to pass the entrance examinations.

For admission to the course leading to the degree of Bachelor of Arts or Bachelor of Science, the subjects and credits assigned each are:

English	3	Physics, Chemistry or Biology	1
Algebra	1½		
Plane Geometry	1	Latin, Greek, French, German or Spanish.....	2
History and Civics.....	1		
		Elective	5½

For admission to the course leading to the degree of Bachelor of Science in Mining Engineering and Metallurgy, Civil Engineering, or Mechanical Engineering, the subjects and credits assigned each are:

English	3	Latin, French, German or Spanish	2
Algebra	1½		
Plane Geometry	1	Physics	1
Solid Geometry	½	Elective	6

For entrance to the course in Mining Engineering and Metallurgy applicants must have both Physics and Chemistry. This leaves but 5 electives for such students.

A student having a credit in Trigonometry not used for entrance, may waive a requirement of three units in college mathematics upon passing a satisfactory examination in that subject.

For admission to the four year course in Agriculture one may substitute two elective units for the two years of foreign language.

SCOPE OF THE ADMISSION REQUIREMENTS

ENGLISH

English—3 credits. (a) English classics. An acquaintance with the works named below. These works are divided into two classes, those intended for thorough study and those intended for general reading. The portion of the examination devoted to the former class will be upon subject matter, form and structure. In addition the candidate may be required to answer questions concerning the leading facts in those periods of English literary history to which the prescribed books belong. In the portion of the examination devoted to the latter class, the candidate will be required to present evidence of a general knowledge of the subject matter, and to answer simple questions on the lives of the authors. In exceptional cases an equivalent amount of reading and study in other than the prescribed works will be accepted as a substitute. (b) English Composition. The examination will take the form of a theme of five hundred words on some subject familiar to the candidate and will be a practical test of his ability to express himself in writing clearly and consecutively. No candidate will be accepted whose work is notably defective in point of neatness, spelling, punctuation, idiom, or division into paragraphs.

No student will be admitted without examination, except on the certificate from his former instructors that the entire requirement has been fulfilled. Substantial equivalents, properly certified, will be accepted.

For thorough study, for 1913: Shakespeare's *Macbeth*, Milton's *Comus*, *L'Allegro* and *Il Penseroso*; Burke's *Speech on Conciliation with America*, or Washington's *Farewell Address* and Webster's *First Bunker Hill Oration*; Macaulay's *Life of Johnson* or Carlyle's *Essay on Burns*.

For general reading and practice, selections will be made, at the discretion of the teacher from groups I-VI of College Entrance Requirements in English for 1912-1913.

MATHEMATICS

Algebra—1½ credits. The work required in Algebra covers the usual fundamental subjects, and extends through quadratic equations, graphical representation of equations, proportions, etc., as given in standard texts, such as Wells' *Essentials of Algebra*, or Wentworth's *High School Algebra*.

Plane Geometry—1 credit. A year is devoted to the subject. The course is based upon the work outlined in text books such as Robbins'

or Wentworth's Geometry, with special reference to original exercises and notebook work.

Solid Geometry—½ credit. A half year is given to this subject. Original exercises and notebook work are required.

HISTORY

To meet the requirement in History the student will be expected to have used, in preparation for each credit, a good textbook, to have done regular reference work, and to have kept a notebook with outlines, summaries, maps, and topical notes on readings, varying according to the advancement of the course.

Ancient History—to the year 800 A. D. 1 credit.

Mediaeval and Modern History of Europe—1 credit.

History of England—1 credit.

History and Government of the United States—1 credit.

LANGUAGE

**Greek*—2 credits. As covered by Gleason and Atherton's *Beginner's Greek Book*; Xenophon's *Anabasis*, four books; Homer's *Iliad*, three books, with composition and the use of Hadley and Allen's or Goodwin's *Greek Grammar*.

**Latin*—2, 3 or 4 credits. As covered by Collar's *First Latin Book* and *Viri Romae*, together with Allen and Greenough's *Grammar* and texts; sight reading; *Caesar*, four books, or an equivalent; Cicero, four orations; Virgil, six books; sight reading from Nepos, Cicero and Gellius; Daniell's or Bennett's *Prose Composition*.

**German*—2 credits. First year: Bacon, *German Grammar*; Storm, *Immensee*; von Hillern, *Hoher als die Kirche*; other readings. Second year: *German Composition*; Meyer-Foerster, *Karl Heinrich*; Heine, Poems and *Die Harzreise*; Lessing, *Minna von Barnhelm*; Schiller, *Wilhelm Tell*.

**French*—2 credits. First year: Frazer and Squair, *French Grammar* (Part I); Aldrich and Foster, *French Reader*; Labiche and Martin, *La Poudre aux yeux*; Halevy, *L'Abbé Constantin*. Second year: *Grammar* (Part II); Merimée, *Colomba*; Lamartine, *Graziella*; Sand, *La Mare au Diable*; Canfield, *French Lyrics*; Victor Hugo, *Les Misérables* (abridged).

**Spanish*—2 credits. First year: Hill and Ford, *Spanish Grammar*; Worman, *First Spanish Book*; Turrell, *Spanish Reader*. Second year: Johnson, *Cuentos modernos*; Alarcon, *El Capitan veneno*; Galdos, *Marianela*; Valdes, *La Alegria del Capitan Ribot*; Umphrey, *Spanish Composition*.

*The courses offered should include the texts outlined, or an equivalent. Two years of one language must be presented, but one or more years of a second language will be accepted as elective.

SCIENCE

Physical Geography—1 credit or $\frac{1}{2}$ credit. A year or half year of work which should include the principles of the subject, as treated in the best recent textbooks, field and laboratory study, and the interpretation and steady use of topographic and weather maps and charts. This subject may be combined in half-credits with physiology, which may in its turn be offered as full credit if it is so desired.

Botany—1 credit or $\frac{1}{2}$ credit. The course should cover a study of the life histories of types from the main groups of plants, and a series of simple physiological experiments. At least two-thirds of the course should consist of laboratory work. Botany as a half-credit may be combined with a half-credit in zoology for a full credit, or year's work, in biology.

Chemistry—1 credit. A year's course of descriptive chemistry, consisting of both class-room and laboratory work, which should include the more common metals and non-metals and their compounds. A careful record of laboratory experiments should be kept.

Physics—1 credit. Along with the use of one of the standard textbooks the year's course should include continuous and systematic laboratory practice, which should be recorded in a notebook.

ELECTIVES

The electives offered for admission should be chosen from the above subjects or any other subjects ordinarily taught in high schools and accepted by reputable colleges and universities.

ADMISSION TO ADVANCED STANDING

Students coming from other institutions of recognized standing are admitted to classes above Freshman upon the presentation of properly authenticated certificates of work done, and when so admitted will be credited in the records of this University with so much of such work as corresponds approximately with the courses required for the desired degree here. Certificates of record should be accompanied by statements of honorable dismissal or leave of absence, and a copy of the register or catalogue showing the content of the credits certified.

ADMISSION FROM ARIZONA NORMAL SCHOOLS

Graduates of the 2-year and 5-year courses in the Tempe and Flagstaff Normal Schools are given a total credit of 32 units in the University, which shall include the cancelling of the requirements in Philosophy, but shall not cancel the requirements in English 1, 2, nor

any entrance requirement, the equivalent of which shall not have been fulfilled.

ADMISSION UPON CERTIFICATE

Since the statutes of Arizona provide the course of study in the high schools of the State "shall be such as, when completed, shall prepare its students for admission into the State University," the University admits without examination graduates of approved high schools of Arizona. Diplomas or corresponding credentials from high schools and preparatory schools in other states, accredited by the state universities of such states, will excuse from examinations in subjects covered by such credentials.

COURSE OF STUDY AND DEGREES

All facilities and privileges of the University are open to qualified persons of both sexes.

The courses offered in the University provide both a liberal training along literary and scientific lines and technical training along engineering, mechanical and agricultural lines. Great latitude of election is given in the literary and scientific courses, but the courses in engineering are more rigid in their requirements. Full details of the various courses follow. The aim in all is to combine the practical with the theoretical instruction. The needs of a young and growing commonwealth are kept in mind, and a steady attempt is made to develop the adaptability and resourcefulness so necessary to meet changing conditions.

The University offers four-year courses of study leading to the degrees of Bachelor of Arts and Bachelor of Science, and to other specialized degrees as shown hereafter. In each course the work is partly required and partly elective, as described by schedules later. Each student doing full work is required to take not less than fifteen hours of class work a week, and will not be permitted to take more than eighteen hours, except on petition granted by the Committee on Registration. In laboratory work a period of from two to three hours is considered the equivalent of one recitation or lecture hour.

Persons of mature age and with sufficient preparation, who are not candidates for degrees, may be admitted to regular classes as special students, provided, however, that in all such cases they show to the satisfaction of the instructors in charge that they can take the course with profit to themselves and without detriment to the regular class. It is expected that those who desire thus to specialize in mineralogy, assaying, geology or surveying, will have had at least a high school

education, or its equivalent, particularly in English, algebra, geometry, physics and chemistry.

The faculty reserves the right to cancel classes in any course of instruction when a suitable number of students fail to register for the course.

Students who complete satisfactorily the required work, and the specified amount of elective work, as shown in the accompanying schedules, will be given the degree of Bachelor of Arts or Bachelor of Science. The special character of any course of study is indicated by adding to the degree the name of the department, as Bachelor of Science in Mining Engineering.

Military science and tactics and physical training are required during the freshman and sophomore years for all male students, and physical training for female students.

Credit toward degrees is given by means of a unit system which assigns to each course of instruction offered a certain number of units or credits. A unit ordinarily represents one class-room hour a week, or its equivalent of two or three laboratory hours, for one semester. One hundred and thirty-one units, including three units in military science and tactics and physical culture, are required for the degree of Bachelor of Arts or Bachelor of Science. The requirements for degrees in the specialized courses are given below.

Any candidate for a degree may present as part fulfilment of requirements for graduation an acceptable thesis embodying the result of a special study of some subject within the range of the course pursued. The subject and the credit value of the thesis are to be submitted for the approval of the faculty at the opening of the senior year, and the completed thesis must be presented not later than three weeks before Commencement Day.

GROUPS OF SUBJECTS

GENERAL: English, Philosophy, Mathematics, Military Science, Physical Training.

GROUP A: Latin, Greek, French, German, Spanish.

GROUP B: Economics, History, Law, Sociology.

GROUP C: Agriculture, Astronomy, Botany, Chemistry, Geology, Mineralogy, Physics, Zoology.

GROUP D: Civil Engineering, Electrical Engineering, Mechanic Arts, Mechanical Engineering, Mining Engineering and Metallurgy.

REQUIREMENTS FOR DEGREES

The units necessary for the different degrees are set forth in the following statement:

BACHELOR OF ARTS: English, 24; Philosophy, 6; Military Science and Physical Training, 3; Group A, 32; Group B, 15; Group C, 16; free elective, 37,—a total of 133 units.

BACHELOR OF SCIENCE: English, 10; Mathematics, 12; French or German, 16; Military Science and Physical Training, 3; Group B, 8; Groups C and D, 40; free elective, 44,—a total of 133 units.

COURSE I

Leading to the Degree of Bachelor of Science in Agriculture

FIRST YEAR

Required

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	3
Mech. Arts 1. (Mech. Drawing)	2	Mech. Arts 8. (Carpentry)	2
Mathematics 1 (Alg. & Trig.)	6	Botany (Taxonomy)	4
Agr. 3. (Stock Judging)	3	Agr. 4. (Dairying)	3
Agr. 1. (Plant Culture)	3	Agr. 2. (Farm Crops)	3
Military Science	½	Military Science	½
Physical Training	¼	Physical Training	¼
	<hr/>		<hr/>
	17½		15¾

SECOND YEAR

Required

Physics 1	4	Physics 2	4
Chemistry III	4	Chemistry III	4
Mech. Arts 9. (Forge and Metals)	2	Mech. Eng. 14. (Small Power Plants and Machinery)	2
Military Science	½	Military Science	½
Physical Training	¼	Physical Training	¼

Options

Agronomy

Botany 1	4	Botany 3	4
Agr. 7. (Dry Farming)	3	Agr. 6. (Plant Breeding)	3

Horticulture

Botany 1	4	Botany 3	4
Agr. 5. (Market Gardening)	3	Agr. 6. (Plant Breeding)	3

Animal Husbandry

Zoology 1	4	Zoology 2	4
Agr. 11. (Hist. of Breeds)	3	Agr. 12. (Poultry)	3

17½

17¾

THIRD YEAR

Required

Agr. 9. (Soil Physics)	4	Agr. 10. (Soil Fertility)	4
Civ. Eng. 19. (Surveying)	3	Civ. Eng. 20. (Irrigation)	3
Agr. 15. (Vet. Physiology)	3	Agr. 16. (Animal Diseases)	3

THIRD YEAR

Options

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Agronomy			
Chemistry 1.....	4	Chemistry 2.....	4
Elective	3	Elective	3
Horticulture			
Agr. 13. (Pomology).....	3	Agr. 14 (Citrus Fruits).....	3
Elective	3	Elective	3
Animal Husbandry			
Agr. 17. (Animal Breeding)...	3	Agr. 18. (Feeds & Feeding)....	3
Elective	3	Elective	3
	—		—
	17		17

FOURTH YEAR

Required

Economics 1.....	3	Economics 2.....	3
	.	Agr. 24. (Farm Management)...	3

Options

Agronomy			
Chem. 3. (Quant. Anal.).....	4	Chem. 4. (Volumetric Anal.)...	4
Agr. 23. (Agron. Literature) ..	3	Elective	6
Elective	6		
Horticulture			
Bot. 11. (Plant Pathology)...	3	Botany 12. (Plant Path.).....	3
Agr. 19. (Small Fruits).....	3	Agr. 20. (Hort. Literature)....	3
Elective	6	Elective	3
Animal Husbandry			
Agr. 21. (Adv. Stock Judg.)...	3	Agr. 22. (Animal Husb. Lit.)...	3
Elective	9	Elective	6
	—		—
	15 or 16		15 or 16

Total 132 or 134 units.

COURSE II

The Short Course in Agriculture

FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Agr. 3 (Live Stock Judging)...	3	Agr. 4 (Dairying).....	3
Agr. 1 (Plant Culture).....	3	Agr. 2 (Farm Crops).....	3
Agr. 11 (History of Breeds)...	3	Agr. 12 (Poultry).....	3
Mech. Arts 1 (Mechanical Drawing)	2	Mech. Arts 8 (Carpentry).....	2
Mathematics or English.....	5	Mathematics or English.....	5
Military Science	½	Military Science	½
Physical Training.....	¼	Physical Training.....	¼

SECOND YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Mech. Arts 9 (Forge and Metals)	2	Mech. Eng. 14 (Small Power Plants and Machinery)	2
Civ. Eng. 19 (Surveying)	3	Civ. Eng. 20 (Irrigation)	3
Botany 1	4	Botany 3	4
Agr. 5 (Market Gardening)	3	Agr. 14 (Citrus Fruits)	4
Agr. 9 (Soil Physics)	4	Agr. 18 (Feeds and Feeding)	3
Military Science	½	Military Science	½
Physical Training	¾	Physical Training	¾

COURSE III

Leading to the Degree of Bachelor of Science in Civil Engineering

FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	3
Math. 1 (Alg. and Trig.)	6	Math. 2 (Analytic Geometry)	6
*Chemistry 1	4	*Chemistry 2	4
Mech. Arts 1 (Mech. Drawing)	3	Mech. Arts 2 (Desc. Geom.)	3
Mech. Arts 3 (Wood Shop)	2	Mech. Arts 4 (Forge Shop)	2
Military Science	½	Military Science	½
Physical Training	¾	Physical Training	¾
	18¾		18¾

SECOND YEAR

Math. 3 (Differential Calculus)	4	Math. 4 (Integral Calculus)	4
Physics 1	4	Physics 2	4
Mech. Arts 5 (Machine Shop)	2	Mech. Arts 6 (Machine Shop)	2
Civ. Eng. 1 (Surveying)	4	Civ. Eng. 2 (Surveying)	4
Elective	3	Elective	3
Military Science	½	Military Science	½
Physical Training	¾	Physical Training	¾
	17¾		17¾

THIRD YEAR

Math. 5 (Analytical Mechanics)	5	Math. 6 (Anal. Mechanics)	4
Astronomy 3	3	Physics 4 (Electrical and Optical Measurements)	3
†Elective	3	Civ. Eng. 14a (Mechanics of Materials)	3
Civ. Eng. 11 (Hydraulics)	4	Civ. Eng. 14b (Materials Laboratory)	1
Civ. Eng. 9 (R. R. Surveying)	2	Civ. Eng. 10 (R. R. Surveying)	2
		†Elective	4

*Students who have not had preparatory or high school chemistry must take, in place of Chemistry 1, 2, Chemistry III, for which college credit will be given. In this case Mineralogy 7 can not be taken in the third year unless Chemistry 1, 2, is elected in the second year.

†In the third year 7 units of electives will be required, 1915-16 and thereafter. For students entering the University prior to 1913-14 the number of electives required in the third year is 5 units.

FOURTH YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Mech. Eng. 3 (Heat Engines)	3	Mech. Eng. 4 (Pumping Ma-	
Civ. Eng. 7 (Steel Mill Build-		chinery)	3
ings)	4	Civ. Eng. 6 (Masonry and Con-	
Civ. Eng. 13 (Irrigation)	4	crete)	4
Civ. Eng. 15 (Contracts, Speci-		Civ. Eng. 8 (Steel Bridges)	4
fications)	2	Civ. Eng. 18 (Sewerage)	3
Civ. Eng. 17 (Water Supplies)	2	Elective	2
Bacteriology	1		
Total, 134 units.	16		16

COURSE IV

Leading to the Degree of Bachelor of Science in Electrical Engineering

FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1	3	English 2	3
Math. 1 (Alg. & Trig.)	6	Math. 2 (Anal. Geom.)	6
Chemistry 1 (or III)	4	Chemistry 2 (or III)	4
Mech. Arts 1 (Drawing)	3	Mech. Arts 2 (Des. Geom.)	3
Mech. Arts 3 (Wood Shop)	2	Mech. Arts 4 (Forge)	2
Military Science	½	Military Science	½
Physical Training	¼	Physical Training	¼
	18¾		18¾

SECOND YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Math. 3 (Diff. Calculus)	4	Math. 4 (Int. Calculus)	4
Physics 1	4	Physics 2	4
Mech. Arts 5 (Mach. Shop)	2	Mech. Arts 6 (Mach. Shop)	2
Civ. Eng. 1 (Surveying)	4	Mech. Eng. 2 (Mach. Design)	2
Mech. Eng. 1 (Mechanisms)	2	Elec. Eng. 9 (Elem. Elec. Mach.)	3
Met. 1 (Iron and Steel)	1	Elective	2
Military Science	½	Military Science	½
Physical Training	¼	Physical Training	¼
	17¾		17¾

THIRD YEAR

Math. 5 (Analytical Mech.)	5	Math. 6 (Analytical Mech.)	4
Mech. Eng. 3 (Heat Engines)	3	Elec. Eng. 2 (Dynamo Elec. Mach.)	4
Elec. Eng. 1 (Elem. Elec. Eng.)	3	Civ. Eng. 14 (Mech. of Mat.)	4
Civ. Eng. 11 (Hydraulics)	4	Elec. Eng. 10 (Seminar)	1
Elective	2	Elec. Eng. 11	2
		Elective	2

FOURTH YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Mech. Eng. 7 (Mech. Lab.).....	2	Mech. Eng. 8 (Mech. Lab.).....	2
Elec. Eng. 3 (Elect. Mach.).....	2	Elec. Eng. 4 (Elec. Traction) ..	2
Elec. Eng. 5 (Elec. Lab.).....	2	Elec. Eng. 6 (Elec. Lab.).....	2
Elec. Eng. 7 (Elec. Design)....	3	Elec. Eng. 8 (Elec. Sta. De- sign)	3
Elective	7	Mech. Eng. 12 (Power Plants) .	2
—	16	Elective	5

Total, 134-139 Units.

16

COURSE V

Leading to the Degree of Bachelor of Science in Mechanical
Engineering

FIRST YEAR

English 1	3	English 2	3
Math. 1 (Alg. & Trig.).....	6	Math. 2 (Anal. Geom.).....	6
Chemistry 1 (or III).....	4	Chemistry 2 (or III).....	4
Mech. Arts 1 (Drawing).....	3	Mech. Arts 2 (Des. Geom.)....	3
Mech. Arts 3 (Wood Shop)....	2	Mech. Arts 4 (Forge).....	2
Military Science	½	Military Science	½
Physical Training	¼	Physical Training	¼
—	18½	—	18½

SECOND YEAR

Math. 3 (Diff. Calculus).....	4	Math. 4 (Int. Calculus).....	4
Physics 1	4	Physics 2	4
Mech. Arts 5 (Mach. Shop)....	3	Mech. Arts (Mach. Shop).....	3
Mech. Eng. 1 (Mechanisms)....	2	Mech. Eng. 2 (Mach. Design) ..	2
Civ. Eng. 1 (Surveying).....	4	Elec. Eng. 9 (Elem. Elec. Mach.)	3
Met. 1 (Iron and Steel).....	1	Elective	2
Military Science	½	Military Science	½
Physical Training	¼	Physical Training	¼
—	18½	—	18½

THIRD YEAR

Math. 5 (Analytical Mech.)....	5	Math. 6 (Analytical Mech.)....	4
Mech. Eng. 3 (Heat Engines) ..	3	Mech. Eng. 4 (Pumping Mach.) ..	3
Mech. Eng. 5 (Mach. Design) ..	2	Mech. Eng. 6 (Mach. Design) ..	2
Civ. Eng. 11 (Hydraulics)....	4	Civ. Eng. 14 (Mech. of Mat.)... .	4
Elective	2	Elective	2
—	16	Seminar	1

FOURTH YEAR

Mech. Eng. 7 (Mech. Lab.).....	3	Mech. Eng. 8 (Mech. Lab.).....	3
Mech. Eng. (Design).....	2	Mech. Eng. 12 (Power Plants) .	2
Civ. Eng. 7 (Steel Mill Bldg.) ..	4	Mech. Eng. 10 (Design).....	2
Elective	7	Civ. Eng. 6 (Concrete Mason- ry)	4
—	16	Elective	5

Total, 134-139 Units.

15

COURSE VI

Leading to the Degree of Bachelor of Science in Mining Engineering
and Metallurgy

FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1.....	3	English 2	3
Chemistry 1.....	4	Chemistry 2.....	4
Math. 1.....	6	Math. 2 (Anal. Geom.).....	6
Mech. Arts 1 (Drawing).....	3	Mech. Arts 2 (Des. Geom.).....	3
Mech. Arts 3.....	2	Mech. Arts 4 (Forge Shop).....	2
Mil. & Phys. Training.....	¾	Mil. & Phys. Training.....	¾
	18¾		18¾

SECOND YEAR

Chemistry 3.....	4	Chemistry 4.....	2
Math. 3 (Diff. Calc.).....	4	Math. 4 (Int. Calc.).....	4
C. E. 1 (Surveying).....	4	C. E. 2 (Surveying).....	4
Physics 1.....	4	Physics 2.....	4
Mineral. 1 (Blow Pipe).....	2	Mineral. 3.....	2
Mil. & Phys. Training.....	¾	Metallurgy 2 (Assaying).....	2
	18¾	Mil. & Phys. Training.....	¾
	18¾		18¾

Summer Work, Min. Eng. 7, six weeks' practical work and report. 2 units

THIRD YEAR

Chem. 5.....	2	Chemistry 6.....	2
Math. 5 (Anal. Mech.).....	5	Math. 6 (Anal. Mech.).....	4
S. E. 11 (Hydraulics).....	4	C. E. 14 (Mat. Const.).....	4
Geology 1 (Gen. Geol.).....	3	Geology 2 (Gen. Geol.).....	3
Met. (7-5b) (Ore Dressing)....	4	Mineral 4	3
		Min. Eng. (Elements).....	2
	18		18

Summer Course Geology 5-6 (Field Geology) 6 units.

FOURTH YEAR

Mech. Eng. (Heat Eng.).....	3	E. E. 9 (Elec. Machinery).....	3
Min. Eng. 1 (General Mining) ..	2	Min. Eng. 2.....	2
Min. Eng. 3 (Laboratory).....	1	Min. Eng. 4.....	1
Min. Eng. 5 or Econ. 21.....	3	Min. Eng. 6.....	3
Geology 3 (Economic).....	3	Geology 4 (Ore Deposits).....	3
Met. 3-5a (Gold, Silver).....	4	Met. 4 (Gen. Met.).....	4
Mineral. 5.....	2	Mineral. 6.....	2
	18		18

COURSE VII

The Two Year Course in Commerce

Unless otherwise indicated each subject is pursued through the year.

FIRST YEAR	UNITS	SECOND YEAR	UNITS
English 1, 2.....	3	Spanish	4
Elementary Accounting.....	2	Commercial Law.....	3
Economics 1, 2.....	3	Economics 5, 5a.....	3
Economics 3, 4.....	4	Economics 19, 20.....	3
History 1, 2.....	3	Business Practice.....	3
	—		—
	15		16

COURSE VIII

The Four Year Course in Commerce

Each subject is pursued through the year.

FIRST YEAR	UNITS	SECOND YEAR	UNITS
English 1, 2.....	3	Foreign Language.....	4
Foreign Language.....	4	Economics 3, 4.....	4
History 1, 2 (or Accounting) ..	3	Economics 5, 5a.....	3
Economics 1, 2.....	3	Science or Mathematics....	4 or 5
Accounting	2		—
	—		15 or 16
	15		

THIRD YEAR	UNITS	FOURTH YEAR	UNITS
Law or Economics 7, 8.....	3	Economics 9, 10.....	3
History	3	English	2
Economics 19, 20.....	3	Econ. 15 or 16 (1st semester) ..	3
Economics 18.....	3	Econ. 12a (2nd semester).....	3
Elective, first semester.....	5	Suggested Optional Electives:	
Elective and Econ. 12, second semester	8	Law	3
	—	Psychology and Ethics.....	3
	17	Electives.....	2 or 3
			—
			16 or 17

ADVANCED DEGREES

Advanced degrees will be given only for work done in residence, to candidates who have received the Bachelor's degree from this institution or one of similar standing. Thirty units of such work, together with a thesis, will be required for the degrees of Master of Arts and Master of Science. The courses in each case will be laid out by those in charge of the departments in which the work for the degree is to be taken, and must be approved by a committee composed of all the heads of departments.

Students who expect to make mining engineering their profession are advised to take a fifth year, or a five-year course, since the four-year course gives insufficient time for a student to master all the subjects that are essential for the practice of mining engineering.

The requirements for the degree of Engineer of Mines are as follows:

Candidates must have completed the course leading to the degree of Bachelor of Science in Mining Engineering and Metallurgy, as given by the University of Arizona, or the equivalent of this course in some school of recognized standing.

The fifth year's course will consist of not less than 30 units of resident work, which will include (1) all of the following courses, the equivalent of which has not been taken by the candidate: Geology 1, 2, 3, 4, 5, 6, 7; Mineralogy 1, 2, 3, 4; Mining Engineering 1, 2, 3, 4, 5, 6, 7, 8; Metallurgy 1, 2, 3, 4, 5, 7. (2) At least 8 units of graduate work in Mineralogy, Geology, Mining Engineering or Metallurgy. (3) The remainder of the 30 units may be chosen from any of the engineering departments, but should not be of lower grade than Junior work. Six months of work underground and in smelters, with a satisfactory detailed report on the same, will be required.

COURSES OF INSTRUCTION

For the hours of classes the student is referred to the horarium issued at the first of the college year.

AGRICULTURE

PROFESSOR CLOTHIER, ASSISTANT PROFESSOR FOWLER, AND MR. JONES

1. Principles of Plant Culture.

PROFESSOR CLOTHIER

Fundamental laws governing the successful culture of plants, such as purity and vitality of seeds; relation of root development to moisture and plant food; function of stem, leaf, bud, and flower, and conditions governing their normal development; relation of the plant to light, heat, and cold, and other conditions of environment; plant propagation, plant manipulation. Lectures and laboratory work. Required of all students in the long course in agriculture, open to students in the short course, and elective to preparatory students.

3 hrs., first semester. 3 units.

2. Farm Crops.

PROFESSOR CLOTHIER

A brief study of cereals and various other farm crops of the United States, and a more detailed study of those that may be grown successfully in Arizona. Origin, history, description, methods of culture, and market demands. Required of all students in the long course in

agriculture, open to short course students, and elective to preparatory students.

4 hrs., second semester. 4 units.

3. Live Stock Judging. ASSISTANT PROFESSOR FOWLER

The judging of different classes of horses, cattle, sheep and swine. In the first part of the work the score card is used; in the latter part practice in comparative judging is given. Animals from the college herd are used, supplemented by live stock belonging to neighboring ranchmen and farmers. Required of all students in the long course in agriculture, open to short course students, and elective to preparatory students. Text: Craig's *Judging of Live Stock*.

3 hrs., first semester. 3 units.

4. Elements of Dairying. ASSISTANT PROFESSOR FOWLER

Secretion and composition of milk and causes of variation in composition; the Babcock test of milk; various methods of cream raising, including a study of the construction and operation of centrifugal separators; methods of making and marketing butter; proper handling of milk on the farm. The laboratory work includes testing milk and other dairy products, operating different makes of cream separators, and making butter. Required of all students in the long course in agriculture, open to students in the short course, and elective to preparatory students.

3 hrs., second semester. 3 units.

5. Home and Market Gardening. PROFESSOR CLOTHIER

Practical and theoretical training in the general principles underlying successful intensive farming, and detailed study of the various crops grown in the home and market garden, with special reference to Arizona conditions. Lectures, laboratory and practice on the farm. Required of students in horticulture. Open to students in the short course.

3 hrs., first semester. 3 units.

6. Plant Breeding. MR. JONES

The general principles of plant breeding; a detailed study of the methods pursued and results obtained by leading plant breeders in the various experiment stations and in private work. Required of all students in agronomy and horticulture.

3 hrs., second semester. 3 units.

7. Dry Farming. PROFESSOR CLOTHIER

Rainfall and other climatic conditions in the various dry farming regions of the world. General dry farming methods; crops adapted to

dry farming; dry farming methods and possibilities in Arizona. Students will be required to review bulletins dealing with experimental work. Lectures and library work. Required of students in agronomy. Open to students who have taken Agriculture 2.

3 hrs., first semester. 3 units.

9. Soil Physics.

PROFESSOR CLOTHIER

Origin, composition and classification of soils; soil temperature and conditions influencing it; soil texture and soil structure as related to tillage, moisture and plant food; various culture methods based on physical properties of soils; irrigation and drainage; mechanical analysis. Required of all students in the long course in agriculture. Open to short course students.

3 lectures and one 3 hour laboratory period, first semester. 4 units.

10. Soil Fertility.

PROFESSOR CLOTHIER

Amount and availability of the various elements of plant food in soils; relation of humus to soil fertility; commercial fertilizers and their application; control of alkali; making and using farm manures; crop rotations; the Rothamstead experiments; theory of toxic substances in soils. Required of all students in the long course in agriculture. Lectures and laboratory work.

3 lectures and one 3 hour laboratory period, second semester. 4 units.

11. History of Breeds.

ASSISTANT PROFESSOR FOWLER

Characteristics of each breed of horses, cattle, sheep, swine and goats are considered at length, and each breed is discussed with reference to its origin, history and development, introduction to America, and adaptability to Arizona conditions. Required of students in animal husbandry, open to short course students, and elective to preparatory students. Text-book: Plumb's *Breeds of Farm Animals*.

3 hrs., second semester. 3 units.

12. Poultry Husbandry.

ASSISTANT PROFESSOR FOWLER

General care and management of poultry, production of poultry for the market, diseases and pests, breed characteristics. Recitations, lectures and laboratory work, including visits to specialized poultry ranches. Required of students in animal husbandry, open to short course students, and elective to preparatory students.

3 hrs., first semester. 3 units.

13. Pomology.

PROFESSOR CLOTHIER

Orchard management, and detailed study of deciduous fruits, including planting, cultivation, pruning, spraying, and description and history of varieties. Attention will be given to fruit judging. Lec-

tures and laboratory work. Open to students in agronomy in the junior year. Required of students in horticulture.

4 hrs., first semester. 4 units.

14. Citrus Fruits.

PROFESSOR CLOTHIER

Culture of citrus fruits with special reference to the citrus districts in the United States. Citrus nursery management; citrus orchard management; citrus insects and diseases; packing and marketing; judging. Open to students in agronomy in the junior year. Required of students in horticulture. Lectures and laboratory work.

4 hrs., second semester. 4 units.

15. Veterinary Physiology.

ASSISTANT PROFESSOR FOWLER

Special physiology of farm animals. Lectures and recitations supplemented by practical experiments in the laboratory. Text: Smith's *Veterinary Physiology*. Required of all students in the long course in agriculture.

3 hrs., first semester. 3 units.

16. Animal Diseases.

ASSISTANT PROFESSOR FOWLER

(a) General and specific causes of diseases and methods of prevention; errors in feeding and in care of animals; sanitation of stables, feeding pens and pastures; preventive inoculation; tuberculin test and veterinary regulations. (b) Diagnosis and treatment of common ailments of farm animals. (c) Simple surgical operations; control of hemorrhage, dressing of wounds, care of the teeth, care of the feet, castration, spaying and caponizing; correction of malpositions and removal of placenta in obstetrical cases, etc. Text-books: Reynolds' *Veterinary Studies*, Mayo's *Care of Animals*. Prerequisites: Zoology 1, Veterinary Physiology, and the student must be registered in Chemistry I or Chemistry III, and in Zoology 2. Lectures, recitations, and clinics. Required of all students in the long course in agriculture.

3 hrs., second semester. 3 units.

17. Animal Breeding.

ASSISTANT PROFESSOR FOWLER

Principles of breeding, including selection, heredity, atavism, reversion, variation, correlation, with a presentation of methods of breeding, such as line breeding, in-breeding, in-and-in breeding, cross breeding, etc. Open to students above the sophomore year in college. Required of students in animal husbandry. Text: Davenport's *Principles of Breeding*.

4 hrs., first semester. 4 units.

18. Feeds and Feeding.

ASSISTANT PROFESSOR FOWLER

Principles of animal nutrition; composition and digestibility of various feeds; construction and use of silos; balanced rations; economical

feeding of animals for various purposes. Prerequisites: Chemistry III and Veterinary Physiology. Required of students in animal husbandry. Elective to students in agronomy and horticulture.

4 hrs., second semester. 4 units.

19. Small Fruits.

PROFESSOR CLOTHIER

Small fruits such as the strawberry, the grape and the various bush fruits. Required of students in horticulture. Elective to students in agronomy and animal husbandry.

3 hrs., first semester. 3 units.

20. Horticultural Literature.

PROFESSOR CLOTHIER

Readings are assigned in bulletins and standard works upon horticulture; daily and weekly reports give the student a comprehensive view of the general field of horticulture and lay the foundation for research work. Required of students in horticulture.

3 hrs., second semester. 3 units.

21. Advanced Live Stock Judging. ASSISTANT PROFESSOR FOWLER

Show yard judging; relation of pure bred live stock to market classes; method of comparative judging. Trips are made to large herds, and students are required to spend several days at the State Fair at Phoenix, judging live stock. Prerequisites: Live Stock Judging 3, and History of Breeds 16. Required of students in animal husbandry. Elective to students in agronomy and horticulture.

3 hrs., first semester. 3 units.

22. Animal Husbandry Literature. ASSISTANT PROFESSOR FOWLER

A study of books and magazines and a review and compilation of bulletins devoted to animal husbandry. The student will be required to use the herd books of the different breeders' associations in studying the pedigrees of the best individuals in the more popular breeds of horses, cattle, sheep and swine. Required of students in animal husbandry.

3 hrs., second semester. 3 units.

23. Agronomy Literature.

PROFESSOR CLOTHIER

Daily and weekly reports upon assigned readings in bulletins and standard works. Designed to round out the student's knowledge of the general field of agronomy, and to prepare the way for research in the subject. Required of students in agronomy. Elective to students in horticulture and animal husbandry.

24. Farm Management.

PROFESSOR CLOTHIER

The purchase, organization, equipment and management of farms with reference to financial returns. Farm accounts, market demands, marketing associations, the farm lay-out, farm buildings, leveling for

irrigation, location and management of ditches, are among the subjects to be discussed. Required of students in the long course in agriculture.

2 lectures and one 3-hour laboratory period, second semester. 3 units.

SHORT COURSE IN AGRICULTURE

This course is offered to meet the demands of prospective homeseekers in Arizona; to give the student unable to afford the time or the means to pursue a full college course a brief introduction to the basis of successful farming, and to give him a measure of that general culture incidental to University life, which makes for good citizenship. It equips young men to take advantage of opportunities and to fill expert positions, which, for young men of such training, are now open in Arizona and will become more frequent as the great reclamation projects being carried on are completed. Vast areas of desert land in Arizona may be reclaimed by pumping, the development of which has scarcely been touched; but to make the most of such opportunities one will need more mechanical skill and more knowledge of the physical properties of soil than the average farmer possesses. The University from time to time has calls for farm managers at good salaries, and such calls will increase in number. Courses in Irrigation Engineering, Farm Management, Soil Physics, Vegetable Gardening, Orchard Management, and Farm Dairying, are especially designed to equip young men to take advantage of these opportunities and positions.

Students will be admitted to the short course who have a general knowledge of the common school branches and sufficient maturity in years to understand the value of their time and opportunity. They will be accorded the same privileges, and required to observe the same regulations, as other students registered in the University and resident upon the campus.

The University is amply equipped with library, laboratory, and green-house facilities, while the development of a farm of 80 acres will give an abundance of practice in the application of knowledge gained in the class room, library, laboratory and green-houses.

ART

ASSISTANT PROFESSOR NEWSOM

History of Painting.

A general survey of the history of painting, as follows: Early Christian and Byzantine, Italian, Spanish, Dutch and Flemish, French, German, English, American. Examination and comparison of the methods of each school and period; a critical study of the great masters, their environment, their works and their influence. Character-

istic details of style are studied from photographs and plates. Lectures by the instructor; investigation and reports on assigned topics by students. Not open to freshmen.

3 hrs., each semester. 3 units, each semester.

ASTRONOMY

PROFESSOR DOUGLASS

1, 2. Descriptive Astronomy.

PROFESSOR DOUGLASS

The sun, moon, planets, and other celestial objects, with constant views of their telescopic appearance, and discussion of the latest theories of the evolution of the universe and the condition of the planets. Non-mathematical; open to all students.

2 hrs., or an equivalent, first and second semesters. 2 units, each semester.

3. Engineering Astronomy.

PROFESSOR DOUGLASS

Latitude, longitude, and time observations, and their reductions, with practice work; astronomical measurements; adjustment and handling of instruments. Course 3 is required of juniors in civil engineering.

3 hrs., or an equivalent, first semester. Two day hours and one evening hour. 3 units.

BACTERIOLOGY

PROFESSOR MESERVE

Elements of Bacteriology.

A limited number of lectures in the second semester, with about twice as many two-hour laboratory periods. Special reference to the significance of bacteria in agriculture, civil engineering, and home.

BIBLIOGRAPHY

MISS LUTRELL

1. Use of Books and Elementary Bibliography. Classification; card catalogues; the more common reference books; bibliographies, indexes, dictionaries, cyclopedias. Open to freshmen and sophomores. Lectures, exercises, preparation of bibliographies.

2 hours, first semester. 2 units.

2. The Library and the School. Library administration, small school libraries, selection and ordering of books, sales catalogues, and practice work.

2 hours, second semester. 2 units.

library routine. Primarily for students intending to teach. Lectures and practice work.

2 hours, second semester. 2 units.

BOTANY**PROFESSOR THORNBERRY, MR. BROWN**

The courses which follow are intended to articulate with the work done in biology in the average western high school.

1. Elementary Botany.**MR. BROWN**

A general view of the four great groups of plants; the morphology of types and their genetic relations. Open to college students and required of students in horticulture and agronomy. Text: Bergen and Caldwell, *Practical Botany*.

2 lectures and 4 hours of laboratory work, first semester. 4 units.

2. Plant Histology.**MR. BROWN**

Microscopy, botanical microtechnique, use of the camera lucida, and the photographic camera. The greater part of the laboratory work is given to the use of chemical reagents and stains in the preparation of microscopic slides. This course is offered for students who are preparing to teach botany or to take advanced work in this subject. Text: Chamberlain's *Methods in Plant Histology*. Prerequisite Botany 1.

2 lectures and 6 hours of laboratory work, second semester. 4 units.

3. Plant Physiology.**MR. BROWN**

Life processes of plants. Investigations of the properties of protoplasm; relations of plants to mechanical forces; influence of chemicals upon plants; relations of plants to water, gravitation, light, respiration, growth and movement. The course will appeal to students of plant physiology, because of our interesting flora and climatic conditions. Required of students in horticulture and agronomy. Text: MacDougal's *Textbook of Plant Physiology*. Prerequisite, Botany 1.

2 lectures and 6 hours of laboratory work, second semester. 4 units.

4. Taxonomy.**PROFESSOR THORNBERRY**

Identification of plants. Intended for those who expect to continue the study of botany, as well as for those who desire to know the common plants about them, both native, and cultivated species. Particular attention to economic plants. Excursions to adjacent mountains, mesas and river valleys. Texts: Coulter and Nelson, *A New Manual of Rocky Mountain Botany*; Gray's *Field, Forest and Garden Botany*; also numerous other reference works. Open to college students, and required of all agricultural students.

2 lectures and 6 hours of laboratory work, second semester. 4 units.

5. Taxonomy.**PROFESSOR THORNBERRY**

Continuation of course 4. Systematic study of our flora; notation of plant types and co-types; herbarium building; the art of keying

plant groups. Original literature is used. Different systems of classification are studied. Open to students who desire to continue the study of taxonomy.

6. General Morphology of Algae and Fungi. MR. BROWN

Open to students who have completed courses 1 and 2. The instructor must be consulted before registration. Prerequisites, Botany 1 and 2. Hours to be determined. 4 units.

7. General Morphology of Bryophytes and Pteridophytes. 4 units.

8. General Morphology of Spermatophytes. 4 units.

9. History of Botany. MR. BROWN

A lecture course dealing with (a) early descriptive botanists; (b) the period of artificial systems; (c) the beginning and development of modern botany; (d) botany and botanists of today. This course requires library work. Prerequisites, Botany 1, 2, 3 and 4.

First semester. 4 units.

10. Grazing Range Studies. PROFESSOR THORNBURG

An economic study of the native grasses, saltbushes, cacti and other forage plants, particularly as concerns their grazing value. Different types of ranges with the relation of rainfall to plant growth; the open range as contrasted with the advantages of fenced ranges. Poison plants and range weeds with means of eradication. Range restoration. Recommended for students in animal husbandry and general agriculture. Prerequisite, Botany 4.

2 lectures and 6 hours of laboratory work, first semester. 4 units.

11. Plant Pathology. PROFESSOR THORNBURG

The principal groups of parasitic fungi and the plant diseases caused by them, together with methods of control. External factors causing pathological conditions in plants. The commoner plant diseases throughout the country. Prerequisites, Botany 1 and 3.

1 lecture and 5 hours laboratory work, first semester, 3 units.

12. Plant Pathology.

Continuation of course 11. Second semester. 3 units.

13. Geographical Botany. MR. BROWN

Plant distribution over the earth's surface, with reasons for such distribution. General aspect of the vegetation characteristic of the hygrophytic forest, the tropophytic forest, the sclerophyll forest, the savannah, the steppe, the desert, the tundra. A considerable amount of reading in addition to classroom and field work is required. The lectures are frequently illustrated. Prerequisite, Botany 4. No laboratory work.

4 hours, first semester. 4 units.

14. Landscape Gardening.**PROFESSOR THORNBERRY**

Native and introduced flowers, vines, shrubs, and trees adapted for growing under southwestern conditions; lawn making, the rose garden, and hardy bulbous species. Different types of landscape gardening, aesthetic arrangement of trees and shrubs in country and urban homes to secure the best results in planting.

3 lectures and 2 laboratory hours, first semester. 4 units.

CHEMISTRY

PROFESSOR GUILD, ASSISTANT PROFESSOR BRINTON AND MR. KLEEBERGER

The instruction in chemistry has two main objects in view: first, to promote general culture; and second, to introduce students to technical work, especially in mining. The first two years' work in general chemistry, qualitative and quantitative analysis, enables the student to take up advantageously the study of mining, agricultural chemistry or metallurgy.

III. Elementary General Chemistry.

A beginning course intended for preparatory students and college students who enter without a year of high school chemistry. Textbook: Stoddard, *Introduction to General Chemistry*.

4 hrs., or an equivalent, both semesters. When taken by college student (year), 8 units.

1, 2. General Chemistry and Qualitative Analysis.**PROFESSOR GUILD, ASSISTANT PROFESSOR BRINTON**

Lectures and recitations illustrating the chemical properties of the elements and their compounds. Textbooks: Mellor, *Modern Inorganic Chemistry*; Tower, *Qualitative Chemical Analysis*, and various reference books. Open to all students who have taken courses amounting to one year each in preparatory chemistry and physics.

2 hrs. and two 3-hr. laboratory periods, both semesters. 4 units, each semester.

3. Quantitative Analysis.**ASSISTANT PROFESSOR BRINTON**

Laboratory practice, with lectures and recitations; the work is chiefly in gravimetric methods of analysis. For students in agriculture, special problems in agricultural chemistry, such as analysis of water, soils, and fertilizer are considered. Open to all students who have taken Chemistry 2.

4 hrs., or an equivalent, first semester. 4 units.

4. Volumetric Analysis.**ASSISTANT PROFESSOR BRINTON**

A continuation of the work in Chemistry 3, special attention being given to the methods of wet assaying employed in the West.

4 hrs., or an equivalent, second semester. 2 units if discontinued March 15th; otherwise, 4 units.

5, 6. Special Quantitative Analysis. ASSISTANT PROFESSOR BRINTON
Analysis of water, gases, oils, minerals, iron and steel. Open to students who have taken Chemistry 4.

2 or 4 hrs., or an equivalent, both semesters. 2 or 4 units, each semester.

*7, 8. Organic Chemistry. PROFESSOR GUILD

Lectures on the carbon compounds; laboratory work in organic analysis and the preparation of organic compounds; vapor density and molecular weight determination. Open to students who have taken Chemistry 3, 4.

4 hrs., or an equivalent, both semesters. 4 units, each semester.

9. Synthetic Chemistry. PROFESSOR GUILD

Preparation of pure chemical compounds from the crude mineral products. Open to students who have taken Chemistry 4.

2 hrs., or an equivalent, first semester. 2 units.

10. Physical Chemistry. PROFESSOR GUILD

Lectures and laboratory work. Historical introduction leading up to a discussion of modern chemical theories. Open to students who have taken Chemistry 3.

2 hrs., or an equivalent, second semester. 2 units.

*11, 12. Chemistry of the Rare Elements. PROFESSOR GUILD

Analysis and synthesis of uranium, molybdenum, tungsten, vanadium and cerium compounds. Open to students who have taken Chemistry 6, 9.

4 hrs., or an equivalent, both semesters. 4 units, each semester.

13. Special Chapters of Inorganic Chemistry.

ASSISTANT PROFESSOR BRINTON

Lectures and laboratory practice on selected topics from the field of recent work in inorganic chemistry. Open to students who have taken Chemistry 3. Chemistry 9 is advised as preparation for this course.

2 hrs., or an equivalent, second semester. 2 units.

CIVIL ENGINEERING

PROFESSOR WATERBURY AND ASSISTANT PROFESSOR KELTON

The courses in this department have been arranged with special reference to the engineering development of the Southwest. Stress is laid on surveying, railroad and structural work, and irrigation engineering. The student receives a thorough and practical knowledge of

the essential principles of his profession, and of the technical practice of the times, so far as this is possible, without sacrificing in other directions.

Some of the courses in civil engineering are offered on a consultation basis. For such courses the class does not meet in a body and periods will not be scheduled. Each student arranges with the instructor for the required consultation periods. In general, two or three consultation periods a week, in each subject, are required of each student. For courses requiring laboratory or drafting work the student must spend as much time in the laboratory or drafting room as may be required to complete the assigned work.

1. Elementary Surveying. ASSISTANT PROFESSOR KELTON

Use and care of surveying instruments, United States system of land surveys, city surveys, computations. Lectures, recitations, drawing, and fieldwork. Textbooks: Tracy's *Plane Surveying*, and Pence and Ketchum's *Surveying Manual*. Open to students who have taken trigonometry, and who have taken or are taking Mechanic Arts 1.

3 hrs. and Sat. A. M., first semester. 4 units.

2. Topographic and Mine Surveying.

ASSISTANT PROFESSOR KELTON

A continuation of Civil Engineering 1. The work of the second semester includes topographic surveying, hydrographic surveying, patent surveys, and underground surveying. Open to students who have taken Civil Engineering 1.

3 hrs. and Sat. A. M., second semester. 4 units.

3. Geodesy.

PROFESSOR WATERBURY

Precise triangulation work, including measurement of base lines, measurement of angles, adjustment and computation of triangulation systems, and adjustment of precise level circuits. Open to students who have taken Civil Engineering 1, 2, and Astronomy 3 or 4. This course may be taken as a consultation course.

1 hr., first or second semester. 1 unit.

6. Concrete and Masonry Construction. PROFESSOR WATERBURY

Theory and practice in reinforced concrete construction. Foundations on land and in water, cofferdams, cribs, caissons, piers, and abutments, retaining walls, dams, and arches. Textbook: Baker, *Masonry Construction*. Open to students who have taken Civil Engineering 14. This course may be given as a consultation subject.

2 hrs., and two 3-hr. drafting periods, second semester. 4 units.

7. Steel Mill Buildings.

PROFESSOR WATERBURY

Graphical and analytical computation of stresses in roof and bridge trusses; details of structural steel designing; complete design with drawings, estimate of weights, and estimate of cost for a steel mill building. Textbook: Ketchum, *Steel Mill Buildings*. Open to students who have taken Civil Engineering 14. This course may be given as a consultation subject.

2 hrs., and two 3-hr. drafting periods, first semester. 4 units.

8. Bridge Design.

PROFESSOR WATERBURY

Computation of stresses due to moving loads upon various points of bridge structures; a detailed study of bridge designs and bridge erections; complete investigation with drawings, estimate of weights, and estimate of cost of a steel bridge. Textbook: Ketchum, *Design of Highway Bridges*. Open to students who have taken Civil Engineering 7. This course may be given as a consultation subject.

2 hrs., and two 3-hr. drafting periods, second semester. 4 units.

9, 10. Railroad Engineering.

ASSISTANT PROFESSOR KELTON

Preliminary and location surveys; simple and easement curves, turn-outs and switches; principles of economic location as based upon cost of construction, operating expenses, alignment, and grades; maintenance of way. The fieldwork consists of the surveys for a railroad of sufficient length to secure familiarity with the methods of actual practice. Each student makes a complete set of notes, maps, profiles, calculations and estimates of cost. Textbook: Allen, *Railroad Curves and Earthworks*. Open to students who have taken Civil Engineering 1, 2.

1 hr., and one 4-hr. field or drafting period, both semesters. 2 units, each semester.

11. Hydraulics.

PROFESSOR WATERBURY

Velocity and discharge from orifices, weirs, tubes, and pipes; flow in sewers, ditches, canals and rivers; measurement of water power; water wheels of various types. Textbook: Merriman, *Hydraulics*. Open to students who have taken Civil Engineering 1, 2 and Mathematics 4.

4 hrs., first semester. 4 units.

13. Irrigation Engineering.

ASSISTANT PROFESSOR KELTON

Engineering principles relating to the construction and maintenance of canals and reservoirs and the various means of diverting, measuring, and pumping water for use in irrigation. Textbook: Wilson, *Irrigation Engineering*. Open to students who have taken Civil Engineering 1, 2, 11, 14.

3 hrs., and one 3-hr. laboratory and drafting period. This course may be given as a consultation subject. First semester, 4 units.

14a. Mechanics of Materials.

PROFESSOR WATERBURY

Analysis and computation of stresses in prisms, beams, columns, and shafts. Textbook: Merriman, *Mechanics of Materials*. Open to students who have taken or are taking Mathematics 5, 6.

3 hrs., second semester. 3 units.

14b. Materials Testing.

ASSISTANT PROFESSOR KELTON

Laboratory work in the testing of materials used in engineering construction, including cement, concrete, wood, iron, and steel. Open to students who are taking or have taken Civil Engineering 14a.

One 3-hr. laboratory, second semester. 1 unit. 2 units additional may be elected, hours to be arranged.

15. Contracts and Specifications.

PROFESSOR WATERBURY

Essentials of a contract; items included in various kinds of engineering contracts and specifications; preparation of a complete set of specifications and a contract. Textbook: Johnson, *Engineering Contracts and Specifications*. Open to all college students. This course may be given as a consultation subject.

2 hrs., first semester. 2 units.

16. Thesis.

PROFESSOR WATERBURY

Assigned work on an investigation, design, or original research. No student is permitted to register in this subject unless his previous work has been of high grade. Open to senior students in civil engineering.

First or second semester. 2 units.

*17. Public Water Supplies.

PROFESSOR WATERBURY

Methods of investigation of available supplies of use, including a study of results of chemical analysis of water, and the bacterial examination of water; methods of purification of water; and a study of the design of water systems. Textbooks: Turneaure and Russell, *Public Water Supplies*. Open to students who have taken or who are taking Civil Engineering 11. This course may be given as a consultation subject.

2 hrs., first semester. 2 units.

*18. Sewerage.

PROFESSOR WATERBURY

Methods of sewerage purification; sewerage disposal plants; and design of sewer systems. Textbook: Folwell, *Sewerage*. Open to students who have taken or are taking Civil Engineering 11. This course may be given as a consultation subject.

3 hrs., first or second semester. 3 units.

19. Agricultural Surveying. ASSISTANT PROFESSOR KELTON

An elementary course in surveying for students in agriculture. The construction and use of surveying instruments; surveying operations having particular application in agricultural and irrigation work. Textbook: Pence and Ketchum, *Surveying Manual*. Open to students who have had high school or preparatory algebra.

2 hrs. and one 3-hr. field period, first semester. 3 units.

20. Principles of Irrigation. ASSISTANT PROFESSOR KELTON

Methods of irrigation, measuring water for use in irrigation, present condition of irrigation development in the United States, irrigation legislation, and methods of establishing water rights. Open to students who have had Civil Engineering 19.

2 hrs. and one 3-hr. laboratory period, second semester. 3 units.

22. Highway Engineering. PROFESSOR WATERBURY

Highway location and construction; construction of city pavements; bituminous materials for dust prevention and road preservation. Prerequisite, Civil Engineering 1. 2 hrs., second semester. 2 units.

ECONOMICS**PROFESSOR CHANDLER AND MR. HUBBARD****1. Principles of Economics.** PROFESSOR CHANDLER

The main principles underlying the science. Special emphasis upon practical illustrations drawn from business activities of today. Open to all college students.

3 hrs., first semester. 3 units.

2. American Business. PROFESSOR CHANDLER

Rise of the factory system in the United States, and origin and development of the leading American industries. History of the tariff from 1789 to 1911 and its relation to the development of agriculture, manufacture and commerce. Special topics: trusts in their relation to high protection; bearing of the tariff upon increased cost of living; conservation of natural resources in relation to the tariff; high protection and decline in American shipping; needed tariff reform; reciprocity; the tariff commission. Open to all college students who have had Economics 1.

3 hrs., second semester. 3 units.

3. Industrial Organization. PROFESSOR CHANDLER

The scientific basis of large scale industry by analyzing the principles of competition, combination, monopoly and the savings of integration. Various business units from the point of view of their comparative efficiency for different kinds of business; methods of business

consolidation; pools; trusts; holding companies; mergers; agreements; community of interest. Scientific management and elements of cost.

2 or 4 hours, first semester. 2 or 4 units.

4. Transportation and Commerce. PROFESSOR CHANDLER

1. Rise of the American railway system; its past and present relation to the development of agriculture, manufacturing, and other industries.

2. The present American railway system; its business organization, methods of combination, and financial operations.

3. Relation of the railroad to the government and the public; rights of the shipper and the investor in railway securities; Interstate Commerce Commission and Federal control of commerce; proposed reforms in State and Federal regulation; government ownership in Europe and Australia, and its practical value if applied to American conditions. Open to students who have had Economics 1. Students taking this subject for credit in the general Commerce Course are required to do sufficient work in the Materials of Commerce for two extra units of credit.

2 hrs., second semester. 2 units.

4a. Business Economics for Engineers.

PROFESSOR CHANDLER AND MR. HUBBARD

Especially for engineering students and others who have only a limited time to study economics. Special problems of capital, labor and organization of importance to the engineer who may enter the business side of mining, transportation, manufacturing and other industrial work. This course is not open to students who have had courses 3, 4 or 5.

2 hrs., either semester. 2 units.

5. Corporation Organization and Finance. PROFESSOR CHANDLER

1. Organization and management; how and where to organize; powers and privileges of corporations in the different states; minority rights.

2. Business development and promotion of various properties and enterprises, with special reference to the promotion and development of mining companies.

2 or 3 hrs., first semester. 2 or 3 units.

5a. Financial Institutions and Investments. PROFESSOR CHANDLER

A study of the investment market, including:

1. Financial agents and institutions; stock brokers; stock exchanges; stock market; money market; function of Wall Street.

2. Investments of securities; methods and laws of investment and

speculation; relative merits of railway stocks, bonds, municipal bonds, industrial, irrigation and mining securities.

2 or 3 hrs., second semester. 2 or 3 units.

7. Introduction to the Study of Society. PROFESSOR CHANDLER

2 or 3 hrs., first semester. 2 or 3 units.

8. Elements of American Politics. PROFESSOR CHANDLER

2 or 3 hrs., second semester. 2 or 3 units.

9. Labor Problems. PROFESSOR CHANDLER

1. Origin of the labor problem and history and growth of labor organizations.

2. Economic and social condition of the working classes in the United States and Europe today, including study of child and woman labor; immigration and its relation to wages and the standard of living of American workmen; sweating system; poverty and unemployment.

3. Organized labor vs. organized capital; strikes and lockouts; closed vs. the open shop; secondary boycott; collective bargaining; employers' organizations.

4. Political and legal aspects; use and abuse of the injunction; police power of the state; recent court decisions; the laborer in politics.

2 or 3 hrs., first semester. 2 or 3 units.

10. Economic Reform Movements. PROFESSOR CHANDLER

This course logically follows Economics 9. The labor question with emphasis upon the constructive side. The chief proposals for the solution in America, Europe and Australia; profit sharing; co-operation; industrial education; compulsory arbitration; labor legislation in the United States.

2 or 3 hrs., second semester. 2 or 3 units.

12. Discussion of Public Questions. PROFESSOR CHANDLER

Students receive training in the handling of public questions, political, economic and social, by means of discussions and debates. Open to all college students.

1 hr., first semester. 2 units.

12a. Seminar in Arizona Problems. PROFESSOR CHANDLER

Open only to advanced students.

1 3 hr. credit, each semester.

13. Elementary Accounting. MR. HUBBARD

An introductory study of simple accounts; the general principles of accounting, meaning of the balance sheet and other reports furnished by firms and corporations, and accounting problems incident to efficient business management. Concrete examples, with special atten-

tion given to farm, engineering, and cost accounting. Open to all college students.

2 hrs., both semesters. 2 units, each semester.

15. Advanced Accounting.

MR. HUBBARD

2 hrs., first semester. 2 units.

16. Municipal Problems.

PROFESSOR CHANDLER

The city in its economic, political, and social aspects.

2 or 3 hrs., first semester. 2 or 3 units.

18. Agricultural Economics.

MR. HUBBARD

Business aspects of rural life; capital and labor as applied to farming, irrigation, forestry and mineral lands; agricultural banking and credit; buying of supplies and marketing of products; the public domain, state and national.

Students of agriculture, who have not taken the work in course 13, covering agricultural accounting, will be given in this course a simplified system of farm accounts.

3 hrs., first or second semester. 3 units.

19. Money and Banking.

MR. HUBBARD

Functions of money and its relation to credit institutions; monetary system of the United States; theory and history of banking; function of the savings bank, the trust company, the clearing house; history of American finance; financial crises in their relation to our present currency and banking systems; examination of the principal banking systems of the world for the purpose of finding ideas which would render the American system more nearly conformable to our growing financial and commercial needs. Open only to juniors and seniors who have had at least one year of economics.

2 or 3 hrs., first semester. 2 or 3 units.

20. Business Economics. PROFESSOR CHANDLER AND MR. HUBBARD

Insurance, real estate and taxation.

2 or 3 hrs., second semester. 2 or 3 units.

21, 22. Principles and Economics of Mining. PROFESSOR CHANDLER

Especially for students of Mining Engineering, and given jointly with the department of Mining Engineering. Same as Mining 5, 6. Not open to students who have had Economics 5 and 5a or Economics 4a.

3 hrs. throughout the year. 6 units.

BUSINESS COURSES IN THE UNIVERSITY

The University now offers two distinct courses in Business, Economics, Commerce and Finance: a two year course in practical busi-

ness economics leading to a certificate; and a four year course leading to the degree of B. S. in Commerce.

The Two Year Course in Business is offered especially for those high school graduates who wish to prepare for business life and who cannot afford to take a four year course in commerce. Emphasis is placed upon the more practical phases of business training.

Any subject in the two year course will be accepted for full credit in the four year course.

One of the valuable features of this course consists of talks given by business men to the students. For the coming year arrangements have been made for several of these talks by men who have had experience in business administration, organization, real estate, fire insurance, life insurance, salesmanship, banking, and trust business.

The Four Year Course in Business Economics, leading to the degree of B. S. in Commerce, is offered to meet the growing demands of the business world for men who are not only liberally educated, but who are also equipped with technical knowledge of finance, business organization and administration. In addition to all that is given in the Two Year Course, the student is required to elect science or mathematics, and more foreign languages. This course allows the student considerable freedom in the choice of electives. Entrance requirements are the same as for the A. B. degree.

ELECTRICAL ENGINEERING

PROFESSOR HENLEY, MR. SNOW AND MR. BRAEUTIGAM

The object of the course in electrical engineering is to furnish thorough instruction and practical training in applied electricity and allied subjects, and in those fundamental principles of science a knowledge of which is necessary as a basis for successful specialization. The laboratory work supplements the lecture and recitation work, training the student to see the close relation between theory and actual operation, and encouraging individual judgment rather than mere development of skill.

Work in electrical engineering proper is not undertaken until the Junior year, but a course in electricity and magnetism may be elected in the Sophomore year. Besides the electrical work courses are given in other engineering subjects, and electives give opportunity for work along non-engineering lines.

1. Elements of Electrical Engineering.

MR. SNOW

The principles of the development of electrical engineering; a brief history of the development of the electrical industry, with modern applications of electricity to transmission of power, electric lighting, the

telephone, street cars, etc.; the theory of the generation and transmission of both direct and alternating currents,—advantages and disadvantages in the use of each.

First semester, junior year. 3 units.

2. Dynamo-Electric Machinery.

MR. SNOW

In part a continuation of E. E. 1. The study of electric illumination, comparing the various light sources, their relative values under different conditions, cost and efficiency of operation. One 3-hour period in the laboratory, making different connections on motors and generators, running machines and making simple tests of them.

Second semester, junior year. 4 units.

3. Electrical Machinery.

MR. SNOW

The fundamental laws of electromagnetic and electrostatic circuits. Algebraic and geometric treatment of electrical problems, in such a manner than an analysis of the structural and performance characteristics of electrical machinery may be easily followed.

2 hrs., first semester, senior year. 2 units.

4. Electric Traction.

MR. SNOW

Practical application of E. E. 3 to generators, motors, and transformers. Electric railways: the railways, generators, rotary-converters, the different types of motors as applied to the work; a comparison of the direct and alternating current systems in electric railroad work.

2 hrs., second semester, senior year. 2 units.

5, 6. Electrical Engineering Laboratory.

MR. SNOW

Operation and characteristics of commercial machines, making complete tests of generators, motors both direct and alternating current, transformers, synchronous converter, etc. The student becomes familiar with actual operation of the machines, common causes of trouble and their remedy.

Two 3-hr. periods, each semester, senior year. 2 units.

7. Design of Electrical Machinery and Apparatus.

MR. SNOW AND MR. BRAEUTIGAM

Paralleling E. E. 3. Effect of design on the characteristics, cost of operation and performance of electrical machinery and apparatus. Practical calculations for designing lifting magnets, finding and plotting the characteristics and predetermination of the operation of generators, motors, transformers and transmission lines.

Two 3-hr. periods and one lecture, first semester, senior year. 3 units.

8. Electric Power Station Design.

MR. SNOW AND MR. BRAEUTIGAM

Selection and arrangement of electric power station equipment;

wiring diagrams and switch-board connections. Transmission line design, calculations of cost of operation, estimated cost of power delivered, and power rates.

Two 3-hr. periods and one lecture, second semester, senior year. 3 units.

9. Electrical Engineering Practice. MR. BRAEUTIGAM

A general course in electrical engineering: electric lighting, transmission and distribution, construction and operation of alternating and direct current generators and motors. Intended for all engineering students.

2 hrs. and one 3-hr. period, first or second semester. 3 units.

10. Seminar. PROFESSOR HENLEY, MR. SNOW OR MR. BRAEUTIGAM

Discussion of various subjects which arise in connection with work, and review of current engineering literature.

1 hr., second semester. 1 unit.

11. Elements of Design.

A drafting room course for junior electrical students.

2 3-hr. periods, second semester. 2 units.

ENGLISH

PROFESSOR BATES, PROFESSOR PERRY, MISS LUTRELL

The purpose of the literary courses outlined below is to give a general knowledge of English literature from its beginnings to the present time, chief stress being laid upon the study of representative authors, but with broader literary movements constantly in mind. The courses in composition aim to develop accurate thought and clear, vigorous expression; opportunity for work in advanced composition is afforded in connection with the courses in literature.

1. Composition.

PROFESSOR PERRY

Exposition; lectures and the study of Perry's *Exposition*; daily and weekly themes. Prescribed for all freshmen.

3 hrs., first semester. 3 units.

2. Composition.

PROFESSOR PERRY

Argumentation; study of Perry's *Argumentation*, class debates, impromptu speeches, and several written arguments. Prescribed for all freshmen.

3, 4. History of English Literature.

PROFESSOR BATES

An outline of English Literature from its beginning down to the present time. Moody and Lovett's *History of English Literature* used as a textbook. Assigned readings from numerous authors. This course is preliminary to all other courses in English literature.

2 hrs., both semesters. 2 units, each semester.

5, 6. Elizabethan Drama.**PROFESSOR BATES**

Development of the Elizabethan drama from the Miracle Plays, Moralities and Interludes; the Senecan influence, the work of Lyly, Greene, Peele, Kyd, and Marlowe; a close detailed study of the leading plays of Shakespeare, followed by a cursory treatment of the post-Shakespearian drama. Lectures and discussions. A play is usually put on at Commencement by the members of this class.

3 hrs., both semesters. 3 units, each semester.

7. Nineteenth Century Literature. The Romantic Period.**PROFESSOR BATES**

The historical development of the romantic spirit and its manifestation in the poetry of Wordsworth, Coleridge, Scott, Byron, Shelley, and Keats, the essays of Lamb, Hazlitt, De Quincey, and Emerson, the fiction of Scott, Hawthorne, Poe, Charlotte Bronte and Emily Bronte.

8. Nineteenth Century Literature. The Victorian Period.**PROFESSOR BATES**

The change of spirit in the Victorian era; the work of the typical Victorians: Tennyson, Macaulay, Dickens, Thackeray, and Eliot; the various forms of revolt in Arnold, Browning, Rossetti, Swinburne, Morris, Carlyle, Ruskin, Meredith, Hardy, and Stevenson.

5 hrs., second semester. 5 units.

9, 10. Principles of Literary Criticism.**PROFESSOR BATES**

A historical study of the chief theories of literary criticism to aid the student in forming satisfactory principles of judgment for himself. In the first semester the following authors are studied: Plato, Aristotle, Sidney, Dryden, Addison, Pope, Johnson, and Burke. The second semester is devoted to writers of the nineteenth century, especially Wordsworth, Coleridge, Shelley, Hazlitt, Poe, Arnold, Pater, and various contemporary critics. Primarily for seniors.

2 hrs., both semesters. 2 units, each semester.

11, 12. Methods of Teaching English.**PROFESSOR PERRY**

Intended for students preparing to teach English in secondary schools. Methods of teaching grammar, rhetoric, composition, literature; discussion of the college entrance requirements in English; blocking out of courses, and planning and presenting of single lessons.

3 hrs., both semesters. 3 units, each semester.

13. Narration.**PROFESSOR PERRY**

An advanced course with emphasis placed on the writing of short stories. Consideration of the problems of the short story writer; the discovery, through analysis of specimen stories, of helpful principles and devices, and experimentation in their application in short story

writing. Frequent short themes and monthly long ones will be required. Open to college students who have successfully completed English 1 and 2.

3 hrs., first semester. 4 units.

14. Public Speaking.

PROFESSOR PERRY

A practical course intended to correct faults in delivery, establish sound standards of oratory, and train students in easy, effective oral expression. Constant class-room practice in informal debates and in other forms of public speaking. Open to students who have finished the required English courses.

3 hrs., second semester. 3 units.

15, 16. Contemporary Literature.

PROFESSOR BATES

Such a study of British and American literature in the last quarter-century as will enable the student to form a clear estimate of present-day tendencies: the decadent and symbolic schools of British poetry, the Irish movement, contemporary American poetry, the romantic and realistic schools of fiction, and the revival of the drama, with especial reference to the influence of Ibsen. Readings assigned in the poetry of Francis Thompson, Dowson, Symons, Henley, Yeats, and Hovey; in the prose of Kipling, Bennett, Wells, Grierson, and Herrick; in the dramas of Ibsen, Pinero, Jones, Shaw, Wilde, Phillips, and Synge. Lectures, discussions and quizzes.

2 hrs., both semesters. 2 units, each semester.

17, 18. Chaucer.

MISS LUTRELL

A large part of the *Canterbury Tales* is read, the *Prologue of the Legende of Gode Wommen*, and some of the minor poems. The course is purely literary and a knowledge of Anglo-Saxon is not required.

3 hrs., both semesters. 3 units, each semester.

19. Advanced Course in Methods of Teaching English.

PROFESSOR PERRY

The course is offered on request for the benefit of seniors who as juniors took English 11 and 12. The work will be a review and continuation of the work of that course.

Second semester. 2 units.

FRENCH

PROFESSOR TURRELL, MR. OTIS

1, 2. Elementary French.

PROFESSOR TURRELL

First semester: Fraser and Squair, *French Grammar*, (Part 1), Aldrich and Foster, *French Reader*. Second semester: Reading of Daudet, *La Belle Nivernaise*, Labiche and Martin, *La Poudre aux*

Yéux, Halévy, *L'Abbé Constantin*. Composition and dictation, with drill on the irregular verbs.

5 hrs., both semesters. 4 units, each semester.

3, 4. Advanced French.

PROFESSOR TURRELL

First semester: Fraser and Squair, *French Grammar*, (Part II), Merimeé, *Colomba* or *Carmen*, Lamartine, *Graciella*, Sand, *La Mare au Diable* or *La Petite Fadette*. Second semester: Selected reading: including Canfield, *French Lyrics*, Victor Hugo, *Les Misérables* (abridged).

5 hrs., both semesters. 4 units, each semester.

5. French Literature to the Nineteenth Century.

PROFESSOR TURRELL

The classical French dramatists: plays of Corneille, Racine and Moliere. Lectures on the eighteenth century: Voltaire, Rousseau, Diderot, and other writers. Beaumarchais, *Le Barbier de Séville*. Library readings.

3 hrs., first semester. 3 units.

6. French Literature in the Nineteenth Century.

PROFESSOR TURRELL

Particular study of the drama. The Romanticists, Victor Hugo, Musset, Scribe, Augier. Recent literary movements in France. Pailleuron, Dumas, Rostand, Zola, Sardou, Hervieu, Maeterlinck, and others.

3 hrs., second semester. 3 units.

7, 8. Advanced Composition and Conversation.

MR. OTIS

Vreeland and Koren, *French Syntax and Composition*, Kron, *French Daily Life*, etc. Original essays and reports in French.

2 hrs., both semesters. 2 units, each semester.

Courses 5, 6, 7, 8 may be taken together or separately, but must be preceded by courses 1, 2, 3, 4.

GEOLOGY

MR. WILLIS

The earlier courses in geology introduce the student to general and applied geology, but with special reference to development of the observational faculties, and to training in inductive and deductive reasoning so that he may discover for himself the causes for the phenomena observed. The more advanced courses are technical and cover the essentials of geology for a mining engineer. The courses in geological mapping give opportunity for field work, and include reconnaissance and detailed field mapping and underground geological map-

ping. Special field work may be undertaken by advanced students under the direction of the department.

1, 2. General Geology.

Geological processes, their causes and effects. The atmosphere, surface and underground water, the ocean and ice and snow as geological agents; earth movements, mountain and continent building, vulcanism; origin and alterations of rocks. Historical geology, reviewing the physical history of the earth and correlated life progress. Summary of the general principles of ore deposits.

Reading and interpreting topographical and geological maps, the fundamentals of geological mapping, structural problems, and stereogrammatic and graphic methods for the solution of problems in faulting. Classification and laboratory study of rocks. Short field trips are taken in the second semester.

3 hrs., both semesters. 3 units, each semester.

3. Economic Geology—Non-Metallic Products.

Statistics, production, utilization, value, occurrence, genesis and methods of investigation of iron and manganese and the non-metallic products, viz.: coal, gas, bitumen, etc.; building stones, clays, cement materials, sands, etc.; borax, phosphates, fluorspar, gypsum, graphite, mica, asbestos, mineral paints, etc.; salines, mineral waters, artesian flows, and investigation of underground water flow, etc.; precious stones.

3 hrs., first semester. 3 units.

4. Economic Geology—Metallic Products.

Detailed study of ore deposits. Prerequisite, Geology 1, 2.

3 hrs., second semester. 3 units.

5. Field Geology. (Summer Work.)

This course is designed to give the student practice in the various processes involved in geological mapping. The work covers, the preparation of a complete topographical map, including triangulation and contouring, the working out and mapping of the areal geology and the study of the economic features of the territory studied.

Two reports are required, one areal and one underground and each must include reconnaissance maps and notes as well as detailed geology. The reports are due November 1st. Open to students who have taken Geology 1 and 2.

Six weeks during the summer between the Junior and Senior years.
6 units. Required in Course VI.

7. Type Fossils.

Identification of type fossils, especially the Paleozoic.

2 hrs., first semester. 2 units.

9, 10. Advanced Ore Deposits.

The literature of special ore deposits or special problems in ore deposition, with microscopic work.

11, 12. Advanced Field Work.

Detailed study and mapping of a selected area, or of a selected ore deposit.

GERMAN**MR. OTIS****1. 2. Elementary German.****MR. OTIS**

First semester: Paul V. Bacon, *German Grammar*. Second semester: Reading of Storm, *Immensee*, Gerstacker, *Germelshausen*. Conversation based on Paul V. Bacon, *Im Vaterland*. Grammar completed.

5 hrs., both semesters. 4 units, each semester.

3, 4. Advanced German.**MR. OTIS**

First semester: Pope, *German Composition*, with review of Syntax. Reading of Meyer-Foerster, *Karl Heinrich*, Heine, poems and *Die Harzreise*. Second semester: Composition continued. Lessing, *Minna von Barnhelm*, Schiller, *Wilhelm Tell*, etc.

5 hrs., both semesters. 4 units, each semester.

5, 6. Lessing, Schiller, and Goethe.**MR. OTIS**

First semester: Reading and interpretation of Lessing, *Emilia Galotti*, *Nathan der Weise*, Schiller, *Maria Stuart*, *Wallenstein*. Accompanied by a brief outline of German literature to the nineteenth century. Second semester: Goethe, *Hermann und Dorothea*, *Egmont*, *Die Italienische Reise*, *Faust*, Part I.

3 hrs., both semesters. 3 units, each semester.

7, 8. German Literature in the Nineteenth Century.**MR. OTIS**

First semester: The Romanticists and their successors. Class reading of Kleist, *Der Prinz von Homburg*, Grillparzer, *Der Traum ein Leben*, *Die Ahnfrau*, etc. Second semester: the rise of Naturalism and Symbolism. Wildenbruch, *Harold*, Fulda, *Der Talisman*, Sudermann, *Johannes*, Hauptmann, *Die versunkene Glocke*. Lectures and library readings.

2 hrs., both semesters. 2 units, each semester.

Note.—Courses 5, 6, 7, 8 may be taken together or separately, but must be preceded by Courses 1, 2, 3, 4.

GREEK
ASSISTANT PROFESSOR NEWSOM

1, 2. Beginner's Course.

White, *First Greek Book*; Goodwin, *Greek Grammar*; and Xenophon, *Anabasis* (first four books).

4 hrs., both semesters. 4 units, each semester.

3, 4. Homer and Plato.

Homer, *Iliad* (first four books); Plato, *Apology* and *Crito*; and selections from Lysias.

4 hrs., both semesters. 4 units, each semester.

HISTORY

PRESIDENT WILDE, PROFESSOR CHANDLER, MR. HUBBARD

*1, 2. Expansion of the American People. **PROFESSOR CHANDLER**

Political, social and economic development and expansion of the American people from the settlement on the Atlantic seaboard down to the recent political activities in the far West. The transplanting of European peoples and institutions, and the adaptation of them to American conditions; the industrial evolution in the United States; the early western movement; the public domain; the development of American democracy; the great social and economic changes accompanying and following the civil war; the settlement of the far West. During the second semester considerable time will be given to the history of the Southwest and to the study of its peculiar problems. Open to all college students.

3 hrs., both semesters. 6 units.

3, 4. Mediaeval History.

PRESIDENT WILDE

European history from the fall of the Roman empire to the close of the Protestant Reformation. The rise of institutions; the political, social, and economic life of the time; influence of the church; development of the modern state. The course gives a foundation for more intensive studies in history and provides a historical basis for the study of economics or other sciences.

3 hrs., both semesters. Hours to be announced. 6 units.

5, 6. Nineteenth Century Europe.

MR. HUBBARD

The liberal and reform movements of Europe since the Congress of Vienna; the evolution of constitutional government; various movements toward national unity; the rise of modern Italy; the Franco-Prussian war; the rise of modern Germany; English reform bills of 1832, 1867, and other political developments.

3 hrs., each semester. 6 units.

*Offered in 1911-12 and alternate years.

7, 8. Constitutional History of the United States.**PROFESSOR CHANDLER**

The formation of the Union and of the political and constitutional history of the United States, based on letters and speeches of American statesmen, public documents and special histories.

3 hrs., both semesters. 6 units.

9, 10. Ancient History.**PRESIDENT WILDE**

A study of the history and institutions of ancient Greece in the first semester. The same general view of the history and institutions of ancient Rome in the second semester. Not offered in 1913-14.

2 hrs., each semester. 2 units.

11. Development of the English Nation.**MR. HUBBARD**

The English people from the earliest times to the end of the Tudor period. The influence of Church and Continental relations; the causes and events relative to the development of English social and political institutions. The student is expected to have a clear idea of the Constitution as developed to the close of the period.

3 hrs., first semester. 3 units.

12. Development of English Party Government.**MR. HUBBARD**

Beginning with the close of the Tudor period, a study of the events and legislation causing and directing the growth of English political parties. The prerogatives of the crown, the development of the cabinet system, elections, methods of legislation, and the reform bills of the nineteenth century.

3 hrs., second semester. 3 units.

13, 14. Modern Europe.**MR. HUBBARD**

European history from the close of the Reformation to the end of the Napoleonic period. During the first semester much time is given to the consideration of European civilization of the seventeenth and eighteenth centuries; the second semester is devoted to an intensive study of the French Revolution and the Napoleonic period.

3 hrs., each semester. 6 units.

LATIN**ASSISTANT PROFESSOR NEWSOM**

The courses below are open to students who have completed the first three years of Latin in the sub-collegiate department, or an equivalent. Constant thorough drills are given in technical grammar and prose composition. In reading, the matter is subjected to grammatical, metrical, rhetorical and historical explanation. The study of the text is made the means of mental discipline, of developing the

faculties of observation and critical judgment, and of acquiring habits of thoroughness and accuracy.

1, 2. *Livy and Cicero.*

Livy, Selections; Cicero, de Senectute, de Amicitia; selections from Cicero's Letters. Exercise in prose composition.

4 hrs., both semesters. 4 units, each semester.

3, 4. *Tacitus and Horace.*

Tacitus, Germania and Agricola, Selections from Histories; Horace, *Odes.*

3 hrs., both semesters. 3 units, each semester.

LAW

MR. GALBRAITH

The University offers but one course in law,—an introductory study, with special emphasis on commercial law. The lectures are given in the evening for the convenience of residents of Tucson who may desire to attend. The course requires a substantial amount of reading in the library.

3 hrs., both semesters. 3 units, each semester.

MATHEMATICS

PROFESSOR GRIMES, ASSISTANT PROFESSOR MEDCRAFT

1a. College Algebra. **PROFESSORS GRIMES AND MEDCRAFT**

Prescribed for all B. S. Courses.

3 hrs., first semester. 3 units.

1b. Trigonometry. **ASSISTANT PROFESSOR MEDCRAFT**

Fundamental formulas of the plane trigonometry with applications to surveying. Prescribed for all B. S. courses.

3 hrs., first semester. 3 units.

Students having had trigonometry may obtain college credit for the subject by passing a satisfactory examination, provided the same work has not been used for entrance.

2. Analytical Geometry. **PROFESSORS GRIMES AND MEDCRAFT**

The fundamental methods of plane and solid analytical geometry. Prescribed for all B. S. courses except Agriculture.

5 hrs. and a 2-hr. laboratory period, second semester. 6 units.

2a. Advanced Algebra. **ASSISTANT PROFESSOR MEDCRAFT**

Continuation of Mathematics 1a.

2 hrs., second semester. 2 units.

2b. Spherical Trigonometry. **ASSISTANT PROFESSOR MEDCRAFT**

Fundamental formulas and principles of the spherical trigonometry, with applications to astronomy. Prerequisite—Mathematics 1b.

2 hrs., second semester. 2 units.

3. Differential Calculus.

PROFESSOR GRIMES

Fundamental principles and formulae of the differential calculus, with their application. Prescribed for sophomores in engineering courses.

4 hrs., first semester. 4 units.

4. Integral Calculus.

PROFESSOR GRIMES

The fundamental principles and formulae of the integral calculus with their applications; including the use of tables of integrals. Prerequisite—Math. 3.

4 hrs., second semester. 4 units.

4a. Advanced Calculus.

PROFESSOR GRIMES

A supplementary course to Mathematics 3 and 4, giving special attention to special methods and applications to geometry, physics, mechanics, and other allied subjects.

2 hrs., second semester. 2 units.

5, 6. Analytical Mechanics.

PROFESSOR GRIMES

The mathematical treatment of the fundamental principles of dynamics, statics, etc. Prerequisites—Mathematics 3, 4. Prescribed for all engineering courses.

4 hrs. and a 2-hr. laboratory period for the first semester. 5 units.

4 hrs., second semester. 4 units.

5a. Differential Equations.

PROFESSOR GRIMES

A course in elementary differential equations, with applications to physics, astronomy, mechanics, and engineering.

2 hrs., first semester. 2 units.

7. Higher Plane Curves.

ASSISTANT PROFESSOR MEDCRAFT

A study of algebraic and transcendental curves, from the analytical and graphical standpoints.

First semester. 2 units.

8. Computation.

PROFESSOR GRIMES

In this course will be given opportunity for the student to become familiar with many of the empirical and theoretical formulae of engineering, mathematics and physics.

Second semester. 2 units.

MECHANIC ARTS

PROFESSOR HENLEY, MR. SNOW

The courses in Mechanic Arts comprise the elements of shop work and drawing. The work consists of lectures, recitations and drawing, tool and machine work. Special regard is had to the needs of students in engineering, to familiarize them with ordinary methods in shop

work valuable to every engineer, rather than to develop the skill of the mechanic.

1. Mechanical Drawing.

MR. BRAEUTIGAM

Elements of mechanical drawing, including lettering, tracing, and blue printing. The subject is treated in a purely mechanical way. The student learns to make and read ordinary working drawings, and acquires some knowledge of ordinary drafting room practice.

2, 3 or 4-hr. laboratory periods. One section each semester. 2, 3 or 4 units.

2. Descriptive Geometry.

MR. BRAEUTIGAM

Elements of descriptive geometry, including problems in warped surfaces and intersection of solids.

1 lecture and 2 3-hr. laboratory periods. One section each semester. 3 units.

3. Wood Shop.

PROFESSOR HENLEY

Bench and machine work; elements of pattern and foundry work.

2 3hr. periods, with occasional lectures. One section each semester. 2 units.

4. Forge Shop.

PROFESSOR HENLEY

Forge work in iron and steel; tempering, case-hardening and annealing; characteristics of iron and steel which affect their working in the shop.

2 3hr. periods, with occasional lectures. One section each semester. 2 units.

5, 6. Machine Shop.

PROFESSOR HENLEY

Elements of machine shop practice, and erection and care of machinery. Work on the drill press, shaper, lathe, and planer, as well as at the bench, and on the erecting floor. Only the ordinary classes of work are taken up, the object being to make it as much as possible, a general engineering course. Open to students who have had courses 1, 3, 4 or an equivalent.

8. Carpentry. Omitted 1913-14.

Wood work, including framing, joining, care of tools, etc.

2 3-hr. periods, second semester. 2 units.

9. Forge and Metal Work. Omitted 1913-14.

Forge work in iron and steel, pipe work, drill press, and care of small machinery.

2 3-hr. periods, first semester. 2 units.

11. Lettering.

Types of letters used for drawings and notes in various branches of work.

1 or 2 3-hr. periods, either semester. 1 or 2 units.

MECHANICAL ENGINEERING**PROFESSOR HENLEY AND MR. SNOW**

The work in Mechanical Engineering deals primarily with the design, construction, and operation of machinery. The course includes a study of mathematics and of such sciences as are of value to all engineers, together with a certain amount of work in the other engineering departments. An effort is made to harmonize the work as much as possible with actual practical conditions.

1, 2. Mechanisms and Elements of Machine Design.

MR. BRAEUTIGAM

Theory and design of linkages, gears, cams, screws, and other machine elements.

2 3-hr. periods, both semesters. 2 units, each semester.

3. Heat Engines.

PROFESSOR HENLEY AND MR. SNOW

Principles of thermodynamics as applied to steam and internal combustion engines. Testing and operation, steam and gas engines, boilers, etc.

2 hrs. and 1 3-hr. laboratory period, first semester. 3 units.

4. Pumping Machinery.

PROFESSOR HENLEY

Various types of pumps and compressors, and their efficiencies under different conditions.

2 hrs. and 1 3-hr. laboratory period, second semester. 3 units.

5, 6. Machine Design.

PROFESSOR HENLEY, MR. BRAEUTIGAM

Design, largely empirical, of various tools or machine parts.

2 3-hr. drafting periods, both semesters. 2 units, each semester.

7, 8. Mechanical Laboratory.

PROFESSOR HENLEY

Testing of different types of engines, boilers, pumps, injectors and other machinery. Inspection of power plants and machinery installations.

2 3-hr. laboratory periods and 1 3-hr. computation period, both semesters. 3 units, each semester.

9, 10. Engine Design.

PROFESSOR HENLEY

Design of the main features of a steam or gas engine, pump or compressor, with the completion of as much of the working details as time permits.

2 3-hr. drafting periods, both semesters. 2 units, each semester.

12. Power Plants.**PROFESSOR HENLEY**

The economic design and operation of power and pumping plants. Problems involving the selection of machinery to perform a given duty with a probable minimum expense.

2 hrs., second semester. 2 units.

14. Small Power Plants and Pumping Machinery.**PROFESSOR HENLEY AND MR. SNOW**

An abridged course in small machinery installations, problems encountered in ordinary small pumping plants. This course is intended for students in agriculture, and is made as non-technical as possible.

2 hrs. and 1 3-hr. elective laboratory period, second semester. 2 or 3 units.

16. Seminar. PROFESSOR HENLEY, MR. SNOW, MR. BRAEUTIGAM

Discussion of various subjects that arise in connection with the work of the department and the review of current engineering literature.

1 hr., second semester. 1 unit.

METALLURGY**PROFESSOR GOODRICH****1. Introduction to Metallurgy.**

Physical properties of metals, alloys, thermal treatment of metals, thermal measurements, fuel, refractory materials, metallurgical processes, furnaces, thermo-chemistry, metallurgy of iron and steel.

Lectures, 1 hr., first semester. 1 unit.

2. Fire Assaying.

Fire assay for gold, silver and lead. Bullion assays. Prerequisite, Chemistry 3, 4.

Three 3-hr. laboratory periods, second semester. (March, April, May.) 2 units.

3. Metallurgy of Gold and Silver.

Stamp milling, chlorination, tube-milling, and filtering, cyaniding, pan-amalgamation; Patio, and Tina processes; hyposulphite leaching practice, etc. Lectures. Prerequisite, Metallurgy 1, 2, 7.

3 hrs., first semester. 3 units.

4. Metallurgy of Lead and Copper.

Sampling, receiving, purchasing, roasting; blast furnace methods, reverberatory furnace methods; pyritic smelting, converting, desilveration of base bullion, electrolytic refining, hydro-metallurgy of copper, etc. Lectures. Prerequisites, Metallurgy 1, 2, 7.

4 hrs., second semester. 4 units.

5a. Metallurgical Laboratory.

Amalgamation, cyaniding, chlorination, hyposulphite lixiviation, etc., tests, together with mill work. This course runs parallel with Metallurgy 3. Lectures.

1 3-hr. laboratory period, first semester. 1 unit.

5b. Metallurgical Laboratory.

Sampling, concentration, mill work. This course runs parallel with Metallurgy 7. Lectures.

1 3-hr. laboratory period, first semester. 1 unit.

6. Metallurgical Laboratory Thesis Work.

Original problems in the treatment of ores, experiments to determine the best method of treatment. The equipment now is as complete as in some of the best commercial ore testing plants, and new machinery is constantly being added.

2 3-hr. laboratory periods, second semester. Time to be arranged.
2 units.

7. Ore Dressing.

Breaking, crushing, separating, concentrating, sampling; mill processes and management. Lectures and recitations. Prerequisite, Metallurgy 2.

3 hrs., first semester. 3 units.

8. Metallurgy of Rare Metals.

Metallurgy of zinc, cadmium, nickel, mercury, bismuth, tin, antimony, cobalt, platinum, tungsten, molybdenum. Lectures. Prerequisites, Metallurgy 1, 2 and 3.

2 hrs., second semester. 2 units.

9. Excursions.

On the completion of the various subjects, trips will be taken to suitable plants, in order to study practically the metallurgical operations. The student thus is enabled to reap the advantage of our location—central in a great metallurgical field.

10. Concentrator and Smelter Design.

A practical metallurgical problem, such as may confront the student on entering practical work. The student may design the plant to suit the ore tested in Met. 6 Course.

3 hrs., or an equivalent, second semester. 3 units.

MINERALOGY**PROFESSOR GUILD**

The main object of the courses in mineralogy is to familiarize the student with facts and methods that enable him to determine the char-

acter of an ore or mineral by observation of its physical properties and by the performance of a few simple tests with the blow-pipe, since in the field and mine recourse can not usually be had to a well equipped chemical laboratory.

1. Determinative Mineralogy and Blow-Pipe Analysis.

Laboratory work with occasional recitations. Textbook: Brush and Penfield, *Determinative Mineralogy and Blow-Pipe Analysis*. Prerequisite, Chemistry 2.

Two 3-hr. laboratory periods, first semester. 2 units.

3. Elementary Crystallography.

Two lectures or recitations per week. Prerequisite, Physics 2. 2 units.

4. Descriptive Mineralogy.

Lectures and recitations on the mode of occurrence, uses and classification of minerals. Study of a large number of hand specimens of minerals. Textbook: Dana, *A Text-book of Mineralogy*. Prerequisites, Geology 1, Mineralogy 1 and 3.

3 lectures, second semester. 3 units.

5. Optical Mineralogy.

With microscopic study of the rock-forming minerals. Prerequisites: Geology 2, and Mineralogy 4.

2 hrs., or an equivalent, first semester. 2 units.

6. Petrography.

Preparation of thin sections of rocks for microscopic study, and study of a type selection of rocks. Prerequisite: Mineralogy 5.

2 hrs., or an equivalent, second semester. 2 units.

7. Crystallography.

Measurement, projection and drawing of crystals. Prerequisite: Mineralogy 3.

Either semester. 2 or 4 units.

MINING ENGINEERING

PROFESSOR GOODRICH AND MR. WILLIS

In this course attention is largely directed to the operations and economics of mining. The laboratory and drafting work is so arranged that the student will have plans and designs which will be of value in the practice of the profession.

Note.—All students in Mining Engineering are required to give a minimum of one hour a week for each unit taken in the Mining Engineering courses, in the preparation of a card catalogue and summary of current technical literature on mining. These cards will be examined each week by the department.

1, 2. Mining Machinery.**MR. WILLIS**

Machinery in its application to mining, taking up in detail: churn and diamond drills, hand and machine tools for excavation, air compression, rock drills, electric drills, tunneling machines, explosives and blasting, hydraulicking machinery, coal mining machinery, methods of haulage including aerial tramways, hoisting machinery, drainage and pumping machinery, ventilation and illumination. Surface plants are studied, including shops, ore bins, head frames, rock houses, breakers, etc.

2 hrs., each semester. 2 units, each semester.

3, 4. Mining Laboratory.**MR. WILLIS**

Parallel to Mining 1, 2; the operation of mining machinery, methods of use, repairs; design and construction of ore bins, head frames, dumping devices, timbering methods, surface plants, etc.

1 3-hr. laboratory period, each semester. 1 unit, each semester.

5, 6, or Economics 21, 22. Principles and Economics of Mining.**MR. WILLIS AND PROFESSOR CHANDLER**

A detailed study of the business of mining. Mine examinations, sampling, reports, valuation of mines, considerations preceding the opening of mines, organization, incorporation, financing, mine promotion, stockholders rights, mining investments, frauds, mine administration, leasing, ore contracts, costs of operations, cost accounting with reference to mines especially, analysis of costs, administrative reports, statistics, royalties, influence of transportation facilities, development of mines, factors governing methods, underground methods, safety costs, mechanical equipment, efficiency, power conditions, surface handling, ore sorting, freight contracts, smelter contracts, labor problems, systems of handling, labor unions, mine accidents, laws regulating, social condition of workmen, mining law of United States and Arizona.

3 hrs., each semester. 3 units, each semester.

7. Practical Mining.

Before entering upon the work of the senior year, all students who are candidates for the degree of B. S., in Mining Engineering and Metallurgy, must have spent at least six weeks in practical underground mining or in practical metallurgical work. The fulfillment of this requirement must be evidenced by the certificate of the superintendent or foreman, and by notes and sketches of the processes observed, and a report of such work must be made before November 1st of the same year. Two units credit are given upon the report with original notes and sketches attached.

8. Elements of Mining.**MR. WILLIS**

This course is to introduce the student to the science of mining and gives a brief but concise summary of all methods of mining. It includes placer mining, open cut mining, quarrying, coal mining and underground mining. The history and importance of the industry and the principal ore mines are studied simultaneously.

2 hrs., second semester. 2 units.

9. Field Excursions.

In connection with the courses in Mining Engineering and Metallurgy, trips are made to mining districts in Arizona and Sonora, usually one or two weeks in March or April. These trips are required of all candidates for the degree of B. S. in Mining Engineering and Metallurgy.

The purpose of these trips is to afford the student an opportunity for close study and inspection of mining and metallurgical plants, and of rock formations and of minerals of commercial value. The students are accompanied by members of the faculty, and effort is made to make the trips of the greatest practical value. The trips are carefully scheduled; notes, with sketches, measurements and photographs are taken, and elaborated into comprehensive reports by each student after the return.

PHILOSOPHY AND EDUCATION**ASSISTANT PROFESSOR STANLEY****1, 2. History of Philosophy. ASSISTANT PROFESSOR STANLEY**

Basal concepts and fundamental problems of philosophical thought as developed historically. Lectures, recitations and assigned readings. Textbooks: Schwegler's *History of Philosophy*; Calkins, *The Persistent Problems of Philosophy*. Open to Juniors and Seniors.

3 hrs., both semesters. 3 units, each semester.

3. Psychology. ASSISTANT PROFESSOR STANLEY

A special consideration of the subject as applied to teaching. Lectures, recitations and collateral reading. To be taken in the Sophomore year. Text: Angell's *Psychology*. Not to be given in 1913-14.

4. Pedagogy. ASSISTANT PROFESSOR STANLEY

Educational evolution, both as a culture fact in the history of civilization and as a foundation for professional work; lectures, giving a brief but comprehensive outline of school systems, a special study of leading educators such as Comenius, Pestalozzi, Froebel, Mann, and others. Arrangements have been made with the Tucson city schools

to provide practice work for this class. Open to students who have taken Philosophy 1.

2 hrs., both semesters. 2 units, each semester.

6. Introduction to Ethics. ASSISTANT PROFESSOR STANLEY

Theoretical and practical ethics; view of the historical development of the science; origin and development of the moral consciousness; application of the principles of ethics to the problems of life. Lectures, discussions and assigned readings. Open to Juniors and Seniors.

3 hrs., second semester. 3 units.

PHYSICAL TRAINING

GYMNASIUM—MR. KLEEBERGER, MR. GALBRAITH, MISS CHAPIN

Such exercises are given the student as will best create and maintain a vigorous physical health, and will at once benefit, interest, and stimulate him. Physical training is prescribed for all freshmen and sophomores from October 1st to May 15th. With the approval of the Director of Athletics, students may substitute some form of regular athletic work for the course in the gymnasium for specified periods.

A. Physical Examination for Men.

MR. KLEEBERGER

About thirty measurements of the body; tests of strength; examination of the heart, lungs, and other vital organs; with inspection for marks of vaccination and physical inequalities. Prescribed for all freshmen and sophomores at the beginning of the year or on entrance into these classes. A second examination is optional with the instructor, but the University may order at any time complete special examination without expense to the student.

1, 2. Gymnastics and Hygiene for Men.

MR. KLEEBERGER, MR. GALBRAITH

Setting-up exercises, calisthenic drills, indoor games, and simple apparatus work. Lectures on the physiology of exercise, personal hygiene and corrective exercises. Required of all freshmen unless excused on recommendation of a physician.

2 half-hour periods, both semesters. 1-2 unit.

3, 4. Advanced Gymnastics. MR. KLEEBERGER, MR. GALBRAITH

A continuation of the work of the first year; the use of apparatus, parallel bars, horizontal bars, horses, rings, out-door runs, etc. When possible the class will be divided into graded sections for special work on the apparatus. Required of all sophomores.

2 half-hour periods, both semesters. 1-2 unit.

5, 6, 7, 8. Gymnastics for Women.

MISS CHAPIN

The work is prescribed for young women as for men, and resembles that for men in its general scope and aim. It is, however, modi-

fied to suit the needs of the young women, emphasis being laid upon poise, carriage, grace, and development. Music is used for class drills, marching and dancing. A gymnasium suit is necessary, consisting of a loose blouse waist, divided skirt, and the regular gymnasium shoes. The waist has a sailor collar trimmed with white braid. Four yards of double width, 54-inch dark blue serge is required. Ready-made suits may be purchased for about \$4 at the gymnasium. Required of freshmen and sophomores.

3 half-hour periods, each semester. 2 units.

ATHLETICS—MR. QUIGLEY, DIRECTOR

The climate of Tucson permits athletics out of doors throughout the academic year. Students who prefer to substitute out-door work for class-work in the gymnasium have this privilege under the supervision of the Director of Athletics. The main out-door sports are football, baseball, tennis, and track work. Every student is encouraged to undertake some form of athletics, and exercise, as in the gymnasium, is graduated to the physical needs and the endurance of the student.

Team work is provided to add interest to the sport. There is an unusually large percentage of students engaged in athletics. Remote-ness from other colleges prevents excessive interest in intercollegiate contests and gives occasion for inter-class games. These have had a most satisfactory development.

Credit for athletic work is given on the same terms as for work in the gymnasium, and there is the same requirement of regular attendance and faithful work.

MILITARY DRILL—PROFESSOR POWELL AND MR. GROSSETTA

Military drill is required of all students not specially excused, three times a week, to the end of the Sophomore year in college. Each student provides himself with the required uniform, khaki for the warm weather, cadet grey for the cooler weather.

The drill is under the direction of an officer detailed from the United States Army. It gives the young man valuable physical exercise, a healthy means of competition with his fellows, and a more intelligent military service to his country should this ever be required.

PHYSICS

PROFESSOR DOUGLASS

The object of this course is to acquaint the student with the fundamental physical principles which underlie the higher courses of chemistry, mechanics and engineering. Note books are required in all courses.

1, 2. General Physics.**PROFESSOR DOUGLASS**

Lectures, recitations and laboratory work. First semester: Mechanics and heat. Second semester: Electricity, wave motion, sound and light. The laboratory experiments give prominence to general electrical measurements, but include the study of wave motions and their application to the other subjects. Prerequisites: A course in elementary physics and Mathematics 1.

2 hrs., and two 2-hr. periods in the laboratory, both semesters. 4 units, each semester.

3. Thermodynamics and Heat.**PROFESSOR DOUGLASS**

The foundation principles underlying mechanical engineering, latent and specific heats, conductivity, expansion, mechanical equivalent, high temperatures, cycles, entropy, properties of steam, etc. Prescribed for third year in mechanical engineering course.

1 hr. and two 3-hr. periods, first semester. 3 units.

4. Electrical and Optical Measurements.**PROFESSOR DOUGLASS**

Electrical machines and instruments used in mechanical engineering, and optical instruments handled in mining and civil engineering courses. Prescribed for the third year in mechanical and civil engineering courses.

1 hr. and two 3-hr. periods, second semester. 4 units.

SPANISH**PROFESSOR TURRELL AND INSTRUCTOR****1, 2. Elementary Spanish. Sections A and B.**

First semester, Hills and Ford, *Spanish Grammar*; Turrell, *Spanish Reader*, begun. Conversation and oral work. Second semester: Grammar and reader completed; additional readings with composition and dictation.

5 hrs., both semesters. 4 units, each semester.

3, 4. Advanced Spanish.

First semester: Reading of Johnson, *Cuentos Modernos*; Alarcón, *El Capitán Veneno*. Second semester: Galdós, *Mariánela*; Valdés, *La Alegría del Capitán Ribot*, etc. Three hours each week during the first semester and two hours during the second will be given to composition, letter writing and syntax, using Umphrey, *Spanish Composition*, and Bonilla, *Spanish Daily Life*.

5 hrs., both semesters. 4 units, each semester.

5. Spanish Literature to the Nineteenth Century.**PROFESSOR TURRELL**

Lectures in Spanish on the early literature of Spain, the "Siglo de Oro," etc., with library readings. Class study of Cervantes, *Don*

Quijote (Selections); Lope de Vega, *La Estrella de Sevilla*; Calderón, *La Vida es Sueño*, etc.

3 hrs., first semester. 3 units.

6. Spanish Literature in the Nineteenth Century.

PROFESSOR TURRELL

Particular study of the drama. Reading of Moratin, *El Si de las Niñas*; Larra, *Partir á Tiempo*; Guitérrez, *El Trovador*; Tomayo y Báus, *Lo Positivo*; Nuñez de Arce, *El Haz de Leña*; Echegaray, *El Gran Galeoto*; Galdós, *Electra*.

3 hrs., second semester. 3 units.

7, 8. History of Mexican Literature.

PROFESSOR TURRELL

Reading of works by the best authors, as included in the *Biblioteca de Autores Mexicanos*, etc.

2 hrs., both semesters. 2 units, each semester.

9, 10. Advanced Spanish Composition and Commercial Spanish.

PROFESSOR TURRELL

A practical course in writing and speaking Spanish. Harrison, *Spanish Correspondence*; Remy, *Spanish Composition*, etc., will be used. Original essays, letters and reports in Spanish. (May be taken with courses 5, 6, but must be preceded by courses 1, 2, 3, 4.)

2 hrs., both semesters. 2 units, each semester.

ZOOLOGY

MR. BROWN

1. Invertebrate Zoology.

Development and anatomy of types of the various phyla of invertebrates. Text: Parker and Haswell, *A Manual of Zoology*.

2 hrs. of lectures and 6 hrs. of laboratory work, first semester. 4 units.

2. Vertebrate Zoology.

A continuation of course 1.

4 units.

3. Histology of the Animal Tissues.

The theory and use of the microscope, the camera lucida, the photomicrographic camera, the use of chemicals in the preparation of microscope slides. The course is primarily a laboratory course.

4 units.

4. Physiology.

A thorough review of high school physiology. Laboratory work is emphasized. A first semester course, open to college students.

4 units.

5. Physiology.

A continuation of course 4. Physiology of secretion, digestion and nutrition takes up the entire semester. Open to college students. Prerequisite, Physiology 4.

4 units.

AGRICULTURAL EXPERIMENT STATION STAFF

ARTHUR H. WILDE, Ph. D., President of the University.
ROBERT H. FORBES, M. S., Director.
JOHN JAMES THORNBERRY, A. M., Botanist.
ALBERT E. VINSON, Ph. D., Biochemist.
CLIFFORD N. CATLIN, A. M., Assistant Chemist.
FREDERICK W. WILSON, B. S., Animal Husbandman.
G. E. P. SMITH, C. E., Irrigation Engineer.
ARTHUR L. ENGER, B. S., Assistant Engineer.
ROBERT W. CLOTHIER, M. S., Agriculturist.
ALEXANDER M. McOMIE, B. S., Assistant Agriculturist.
GEORGE F. FREEMAN, B. S., Plant Breeder.
DONALD F. JONES, B. S., Assistant Plant Breeder.
AUSTIN W. MORRILL, Ph. D., Entomologist.
CARLOS C. CABLE, Secretary.
HELEN M. A. MILLER, Librarian.

ORGANIZATION AND WORK

The Agricultural Experiment Station is a legally constituted department of the University, whose purpose is to aid "in acquiring and diffusing * * * useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science."

The organization of the station includes the departments of administration, agriculture, horticulture, animal husbandry, botany, entomology, plant breeding, chemistry, and irrigation investigations, the whole or a major portion of the time of one or more members of the station staff being devoted to each department of the station work. Provision is made for Farmers' Institutes, by means of which the results of experiments and investigations in agriculture are carried to the farmers throughout the state.

Owing to wide variation in agricultural conditions in Arizona, it has been found of advantage to distribute the work so that each department is located, so far as possible, in that region most favorable to the accomplishment of its own special results. According to this principle, the various lines of Experiment Station work have been distributed as follows:

The Director's office and the departments of botany, plant breeding, chemistry, and irrigation investigations are maintained at Tucson in the University buildings. From this base of operations the three

great agricultural districts of the State—Salt River Valley, the lower Colorado, and the upper Gila—are accessible with equal convenience for field work and observations.

For the same reason—fitness of location for the work undertaken—the Experiment Station Farm has been maintained and strengthened at Phoenix. Salt River Valley is intermediate in elevation, in situation, and in mean yearly temperature, between the other two important farming districts of southern Arizona, and for this reason the agricultural and horticultural results obtained there are capable of general application in the southern part of the state.

The date palm orchard, conducted in cooperation with the United States Department of Agriculture, is situated in the alkaline district south of Tempe, where a successful demonstration of this palm as a commercial fruit producer will be of the greatest value, creating use for great areas of alkaline land in the arid Southwest.

The demonstration farm near Yuma, in the fertile Colorado valley bottom, has likewise afforded a succession of object lessons to the public of that locality, as well as much needed information concerning crops, agricultural methods and markets for that rich region.

Experiments in dry-farming have been undertaken on tracts in the Sulphur Spring Valley, in the neighborhood of Snowflake in Navajo County, and near Prescott, in localities typical of large areas.

The range station, also, for the study of worn-out range country with a view to its reclamation to usefulness, is conducted in a typical district near Tucson, and is operated under the auspices of the department of botany, cooperating with the United States Department of Agriculture.

The results of the Experiment Station work are made public at frequent intervals in the bulletins and reports of the Station. These publications are made in two series: First, the longer and more technical bulletins, stating in considerable detail the investigations as they mature; and, secondly, the Timely Hints for Farmers, which are brief writings issued at the time when they will be most useful, written in plain language, and presented in popular form.

Along its several general lines of effort the Station during the fourteen years ending with 1912 has issued 129 publications, exclusive of annual reports which contain much technical information of similar character. These publications may be classified as follows:

Soils, waters, alkali, and farm management, 26; climate, 3; crops, 50; weeds, insect pests and plant diseases, 16; irrigation, 13; animal industry and the range, 21.

Since for years past the mailing list has enabled us to reach from forty to fifty percent of the farming population of Arizona, it is not surprising that the effects of Station work are now generally in evidence, more particularly in our irrigated southern valleys.

Continuing with former appropriations the First State Legislature set aside \$18,000 for the use of the Experiment Station for the fiscal year ending June, 1913. This appropriation provides for printing, for Farmers' Institutes, for dry farming experiments, and for the maintenance of the date orchards at Tempe and Yuma. The El Paso & Southwestern Railroad has also contributed \$5,000 for hydrographic and dry farming investigations in Sulphur Spring Valley. Supplementing the Federal funds, therefore, provision is made for the symmetrical development of this work in the State, both experimentally and educationally; and, prospectively, "the farmer's college" bids fair to increase in usefulness to the growing agricultural interests of Arizona.

BUREAU OF MINES AND ASSAYING

A separate department of the School of Mines under the name of "The Bureau of Mines and Assaying" has been established to receive and work ores, and to make assays and analyses of ores, minerals, mineral waters and petroleum.

Assays of ores and minerals are made for prospectors and miners of Arizona and for others at fixed rates established by law, and tabulated below. To meet the requirements of this work a special laboratory has been erected and maintained. Qualitative determinations of the nature of samples are made free.

Extreme accuracy and excellence of work are considered of more importance than pecuniary profits. All assays are made in duplicate and if not accordant are repeated. The work of the Bureau is under the personal direction of the professor of metallurgy.

The money received for assaying is deposited monthly to the credit of the assay fund which is used to pay the assayer and the cost of material and apparatus.

RATES FOR ASSAYING AND CHEMICAL DETERMINATIONS COMMON ASSAYS AND CHEMICAL DETERMINATIONS

In accordance with the Act of the Legislature of Arizona, approved March, 1897, and amended in March, 1899.

One element only:

Gold, or silver, or copper, or lead, or iron, or insoluble.....\$ 1.00
Zinc, or calcium, or magnesium, or sulphur, or manganese.... 1.50

Silicon or chlorine.....	2.00
Combinations:	
Gold and silver.....	1.00
Copper and iron, or lead and iron.....	1.50
Insoluble, copper, and lead.....	2.00
Insoluble, copper, and iron.....	2.00
Insoluble, lead, and iron.....	2.00
Insoluble, zinc, and iron.....	2.50
Insoluble, lead, copper, and iron.....	2.50
Gold, silver, copper, and lead.....	2.50
Gold, silver, copper, iron, and insoluble.....	2.50

SPECIAL CHEMICAL DETERMINATIONS

One element only:

Aluminum, or tungsten, or barium, or chromium.....	3.00
Cadmium, or tin, or arsenic, or bismuth, or antimony, or titanium, or sodium, or potassium, or uranium, or phosphorus..	4.00
Nickel, or cobalt, or molybdenum, or vanadium.....	5.00

CHEMICAL ANALYSIS

Coal and coke analysis, giving moisture, volatile combustible matter, fixed carbon and ash.....	5.00
The same, including determination of sulphur and phosphorus	7.50
Silicate analysis.....	15.00
Cement analysis (chemical).....	15.00
Cement analysis (mechanical).....	2.50
Cement tests for strength and soundness by the Department of Civil Engineering.....	5.00
Boiler water analysis.....	10.00

RATES FOR TESTING ORES

Stamp mill amalgamation, including sampling, assays, retorting, etc.:

For lots of one ton or thereabouts.....	\$30.00
The same, with concentration of pulp on Wilfley table.....	30.00
For lots of two tons, without concentration.....	40.00
For lots of two tons, with concentration.....	45.00

Smaller amalgamation tests, including all sampling charges, and concentration after amalgamation:

For small samples, up to five pounds.....	\$ 7.00
For small samples, five to twenty-five pounds.....	10.00
For small samples, twenty to one hundred pounds.....	15.00

In these smaller tests, the sample is ground to pass a suitable mesh, and is agitated with mercury. The mercury is panned out, retorted,

the values determined in bullion. The values in the concentrates and tailings are also determined. The number of tests necessary to determine the adaptability of any ore to treatment in cyaniding varies so greatly that no general rates can be offered.

See Metallurgy for more complete description of equipment.

CONSIGNMENTS AND REMITTANCES

Samples, ores, and other consignments should be shipped to the University of Arizona, Tucson, Arizona. Small quantities may best be sent by parcel post; larger quantities by express or by freight. The Wells Fargo Express Company makes daily deliveries at the University.

All assays, chemical determinations and chemical analyses, except gratuitous qualitative tests mentioned elsewhere, must be paid for in advance. Remittances should be made by postoffice money order, Wells Fargo money order, bank draft, or check on a Tucson bank, payable to University of Arizona, business communications relating to matters discussed in this circular being addressed to the Business Manager of the University.

EXTENSION LECTURES

In the current year the University has begun a system of extension lectures under an appropriation made by the legislature of 1912. The University responds to requests for lectures in various fields of its work, giving these lectures without cost to the community for service or transportation. Whenever possible, the community provides the entertainment for the speaker.

THE SUB-COLLEGIATE DEPARTMENT

FACULTY, 1912-1913

ARTHUR HERBERT WILDE, Ph. D., President.

IDA C. REID, Ph. M., Principal; Mathematics and History.

WILLIAM W. HENLEY, A. B., Shop Work and Drawing.

ANDREW ELLICOTT DOUGLASS, D. Sc., Physics.

ROBERT W. CLOTHIER, M. S., Agriculture.

CAPT. HIRAM M. POWELL, Military Science and Tactics.

CHARLES A. TURRELI, A. M., Spanish and French.

WILLIAM G. MEDCRAFT, A. M. Mathematics.

PAUL M. P. BRINTON, M. S., Chemistry.

LEVONA PAYNE NEWSOM, Ph. D., Latin and Greek.

WILLIAM J. GALBRAITH, A. B., Physical Training.

WILLIAM L. FOWLER, B. S., Animal Husbandry.

ELSA CHAPIN, A. B., English.

ARTHUR H. OTIS, A. B., German.

LOYD C. ELLIOT, Physics.

By vote of the Regents of the University the first year of the Sub-Collegiate Department was discontinued after June, 1912, and the second year will be discontinued after June, 1913.

GENERAL INFORMATION

This department aims to give only such subjects as will supplement defective training for college entrance requirements; at the same time it offers an opportunity to the students from the small high schools, having only two or three years of work, to complete their academic training.

Admission to the sub-collegiate courses presupposes the completion of two years of high school work. Students who do not bring certificates showing the completion of this work must take examinations to test their ability to pursue profitably the work desired. Final decision in the matter rests with the committee on registration. A certificate is granted to all students who have completed satisfactorily the work required for entrance to the Liberal Arts courses of the University. Students who have completed the entrance requirements of a university course are admitted to that course without examination.

LIVING ACCOMMODATIONS AND EXPENSES

A portion of South Hall is set apart for the use of male preparatory students; young women are accommodated in West Cottage. Details of furnishings and living expenses are set forth in a paragraph earlier in this Register. These expenses are substantially the

same for both college and sub-collegiate students, save that laboratory fees and book bills are higher for the former. The expenses necessarily incurred during the academic year are about \$300, but of this amount nearly one-third falls due in the first month, or in the six weeks before November 1st, in the form of charges which are made but once during the year. The following are the estimated ordinary expenses for the first month:

Incidental fee.....	\$10.00
Dormitory fee, first payment.....	3.00
Mattress, blankets, pillows, etc., (unless brought from home). .	15.00
Board by the month.....	20.00
Books	6.00
Shop and Drawing fee.....	1.50
Military uniform.....	14.50

	\$70.00

Students who have completed the entrance requirements of a University course are admitted to that course without examination. The entrance requirements to the various University courses are repeated below for the convenience of the sub-collegiate student.

Admission requirements for the Bachelor of Arts or Bachelor of Science course:

English	3 units*	American History and Civics	1 unit
Language other than English	2 units	Physics, Chemistry or Biology	1 unit
Mathematics (1½ algebra, 1 plane geometry)....	2½ units	Electives	5½ units
			Total, 15 units

Admission requirements for the four-year course in Agriculture are the same as those for the general B. S. degree, excepting that language, other than English, is elective. Admission to the short course in Agriculture is possible without previous high school work.

Admission requirements for the engineering courses are as follows:

English	3 units	Mathematics	3 units
Language other than English	2 units	Physics or Chemistry.....	1 unit
		Electives	6 units

Total, 15 units

For Civil, Electrical, and Mechanical Engineering, Physics is required.

For Mining Engineering both Physics and Chemistry are required, leaving only five electives.

*A unit represents a subject pursued for one year with five or four recitation periods a week.

The following distribution of work is required, unless, in the opinion of the registration officer, there is good reason for departing from it:

FIRST YEAR—Discontinued.

SECOND YEAR—In 1913-14 all the work of the second year will be discontinued except English and Advanced Algebra.

THIRD YEAR

English	5 hrs.	*Languages, other than English, each	5 hrs.
Plane Geometry	5 hrs.		
Chemistry	5 hrs.	Electives	5 hrs.

FOURTH YEAR

American History and Civics	5 hrs.	Solid Geometry, 2nd Sem	5 hrs.
And any three of the following:		Physics	5 hrs.
		Languages, each	5 hrs.

Mechanic Arts 5 hrs.

OUTLINE OF STUDIES

ENGLISH

The courses in English are planned to give the student knowledge of the fundamental requirements of grammar and rhetoric, to make him acquainted with good literature, and to establish good habits in written and oral expression and in reading. The time is therefore divided between the study of composition and literature.

COURSE I. Required of all students who do not bring certificates showing the completion of at least two years of High School English.

COMPOSITION AND GRAMMAR. Scott and Buck; *A Brief English Grammar*. Thorough drill in grammar and correct usage. Principles of composition, with constant practice in the writing of themes.

LITERATURE. For close study and class room discussion, George Eliot *Silas Marner*, Tennyson *Idylls of the King*, (Selections) Shakespeare *Julius Caesar*, Addison *Sir Roger de Coverley Papers*, Hearn *Kotto*. For supplementary reading: Scott, *Lady of the Lake*, *Kenilworth*, Poe *Short Stories*, Blackmore *Lorna Doone*, Dickens *Oliver Twist*, Holmes *Elsie Venner*.

COURSE II. COMPOSITION AND RHETORIC. Principles of rhetoric applied to structure of expository themes and informal argument; topical outlines; analysis of essays studied in class.

LITERATURE. Dickens *David Copperfield*, Macaulay, *Essays on Addison and Johnson*, Wordsworth Short Poems, Burke *On Conciliation*, Lincoln *Selected Speeches*, Milton *Short Poems*, Shakespeare

*Since one language must be continued through two years to meet entrance requirements, the election of the first foreign language should not be delayed beyond the beginning of the third year.

Twelfth Night, Macbeth, Spenser one book of Faerie Queene, Chaucer Prologue.

MATHEMATICS

ALGEBRA. Second year, one semester; involution, evolution, theory of exponents, radicals, quadratic equations and proportion. This course is required for entrance to the engineering courses in college.

PLANE GEOMETRY. Emphasis is laid on thorough work in original exercises. **SOLID GEOMETRY.** Second semester, with original exercises.

MECHANIC ARTS

This work consists of both drawing and shop work, between which subjects the student's time is about equally divided. The course covers one year and furnishes a thorough elementary knowledge of manual training as taught in the secondary schools of the country.

DRAWING. Freehand sketching in perspective and orthographic projection. Reinhart's lettering, freehand working drawings. Mechanical drawing and geometrical problems.

SHOP WORK. "Sloyd," care and use of woodworking tools. Forging, joinery, wood turning.

SCIENCE

The courses in science initiate the student into the processes and methods used in laboratory work; teach close observation, careful manipulation and logical deduction, together with the fundamental facts of the various branches of science.

AGRICULTURE

The following courses in Agriculture may be elected by preparatory students: Agr. 1 (Plant Culture), Agr. 2 (Farm Crops), Agr. 3 (Live Stock Judging), Agr. 4 (Elements of Dairying), Agr. 11 (History of Breeds), Agr. 12 (Poultry).

Any two of the above half-year courses will count one credit in the preparatory course. For description of the courses, see index under Agriculture.

BIOLOGY

The course extends through the year, botany being offered the first semester, zoology the second. The plant is studied as a living individual in all its relations; plant societies and plant groups. Text, Coulter, *Plant Studies*. Types of invertebrates and vertebrates are studied in regard to anatomy, physiology, habits, etc. Text, Kellogg, *The Animals and Man*.

CHEMISTRY

A year's work with the text and in the laboratory, in such proportions as the instructor decides upon. Each student must keep a note-

book in which he describes the process and results of his laboratory work.

PHYSICS

The course shows that physics is not something abstract or mysterious, but is the simple explanation of everyday occurrences not usually understood and often unnoticed. It consists of three recitation periods and four laboratory periods per week, pursued along the lines laid down for the senior year in secondary schools. Each student keeps a notebook in which a minimum number of experiments are written up.

HISTORY

The work in history leads the pupil to see the development of the American people along political, social, and economic lines, and to arouse in him a love for the subject and a habit of broad and discriminating reading.

The text in history will be James and Sanford, *American History*, or Channing, *Students' History of the United States*. In civics the historical development of the subject is made prominent, while practical problems, such as taxation and municipal government, are made the subjects of special investigation and study. Hart, *Actual Government*, or Foreman's *Advanced Civics*, is the textbook.

LATIN, GREEK, FRENCH, SPANISH, AND GERMAN

One of these languages must be pursued for at least two years.

For an outline of the courses in Latin, Greek, French, Spanish and German, see under requirements for admission.

HONORS, PRIZES AND SCHOLARSHIPS, 1911-12, 1912-13

HONORS

The University gives formal recognition to the highest attainment in scholarship. Those students who carry one-half of full work (30 units) with a grade of A and the other half with not less than a grade B are entitled to Senior, Junior, and Sophomore Scholarships in those respective years, and to Honorable Mention in the Freshman year and in the Senior year of the Preparatory Department. These Scholarships carry no financial remuneration, but are recognized as the highest undergraduate distinction attainable.

In the year 1911-12 Honors were awarded as follows:

Senior Honors, CATHERINE W. GOODRICH, HARRY W. LUSK,
GEORGE NISHIHARA.

Junior Honors, HOWARD W. ESTILL.

Sophomore Honors, MAUD MACPHERSON.

Honorable Mention in the Freshman Class, ROBERT A. B. GOODMAN,
PERCY F. MINISTER.

Honorable Mention in the Preparatory Graduating Class, CHARLES
W. ISBELL, MARCUS T. KENDALL.

PRIZES

THE MILITARY PRIZES

For their interest in the military department of the University Captain Hiram M. Powell, Commandant of Cadets, and Mr. Merrill P. Freeman of Tucson, sometime regent of the University, have annually presented prizes to the best drilled students,—a sword, the gift of Captain Powell, as first prize, and a medal, the gift of Mr. Freeman, as second prize. In the year 1911-12 these prizes were awarded as follows:

The Powell Sword, CLIFTON H. ROLFE.

The Freeman Medal, LEO F. CLOUD.

THE DRACHMAN PRIZES

Mr. Harry A. Drachman, of Tucson, offers to the students of the University two annual cash prizes of \$25 and \$15 respectively, the contest open to all students of the University.

During the academic year 1910-1911, the prizes were offered for the two best debates. Since that time they have been offered for the two best theses written upon subjects of historical or practical importance in Arizona. Theses are not limited in length and will be judged for originality of investigation and logical development of subject matter. The literature dealing with political, social, historic, and economic problems of the Southwest, collected by the Department of Economics, is available for all students competing for these prizes. In the year 1911-12 the prizes were awarded as follows:

First Prize, ARTHUR L. LOVEJOY.

Second Prize, LAURA MAY SWAN.

THE TROUTMAN MEDALS

Dr. George D. Troutman, of Tucson, to stimulate interest among the students in the chemistry of pure foods, offers two medals, of gold and silver, as prizes for superior work in chemistry. In the year 1911-12 these medals were awarded as follows:

The Gold Medal, FRANK L. CULIN, JR.

The Silver Medal, JAMES D. SULLIVAN.

THE STEINFELD PRIZES

As an expression of interest in University athletics and to stimulate wholesome competition in the student body, Albert Steinfeld & Com-

pany, of Tucson, donated to the University for the year 1911-12, athletic prizes that were awarded as follows:

- The Loving Cup, LOUIS C. BRICHTA.
- The Boxing Prize, LOUIS C. BRICHTA.
- The Gymnastics Prize, LOUIS C. BRICHTA.
- The Wrestling Prize, HERBERT R. AYLWORTH.
- The Track Prize, LOUIS LEFKO.
- The Tennis Prize, LEO F. CLOUD.

SCHOLARSHIPS

During the academic year 1912-13 the County Scholarships have been awarded as follows:

- Pima County, FRED W. ROGERS of Tucson.
- Maricopa County, JOHN W. GETSINGER of Phoenix.
- Yuma County, RUBY LIVINGSTON of Yuma.
- Cochise County, MARGARET POISER of Douglas.
- Gila County, TURNER C. SMITH of Globe.
- Graham County, ALMA SESSIONS of Thatcher.
- Yavapai County, RALPH BELL of Prescott.
- Apache County, LEVI S. UDALL of St. Johns.
- Greenlee County, ALLEN C. JONES of Clifton.

The Tucson Women's Club Scholarship has been held during the year 1912-13 by

MAUD MACPHERSON of Nogales.

The Bennett Scholarship was awarded to

ALICE PATTON LAWSON of Pearce.

MILITARY ORGANIZATION—1913-14

CAPTAIN HIRAM M. POWELL, U. S. A., Commandant of Cadets

STAFF

Assistant Commander.....	Major W. A. Grossetta
Act. Adjutant.....	L. R. Jackson

COMPANY A

Captain.....	W. M. Brewer	Sergt.....	S. Caruthers
1st Lieut.....	F. C. Mack	Sergt.....	G. W. Scheerer
2nd Lieut.....	Richard Lindsley	Corp.....	H. Mayhew
1st Sergt.....	J. W. Getsinger	Corp.....	H. A. Woods
Sergt.....	N. C. Hayhurst	Corp.....	L. Lefko
Sergt.....	M. Kendall	Corp.....	M. O'Neill

COMPANY B

Captain.....	A. J. Halbert	Sergt.....	W. H. King
1st Lieut.....	L. R. Jackson	Sergt.....	A. A. Benedict
2nd Lieut.....	C. R. Jones	Corp.....	B. Minor
1st Sergt.....	C. E. Pickett	Corp.....	P. Minister
Sergt.....	L. F. Cloud	Corp.....	W. Murphrey

BAND

Band Master.....	Prof. F. C. Kelton
Drum Major..F. J. Hobson, Jr.	Band Sergt.....Chas. Balderas

ALUMNI REGISTER

The Alumni Association of the University of Arizona, organized on the second day of June, 1897, represents the body of graduates of the University; its object, as expressed in its constitution, is "To promote the interests of the University, to secure unity among its graduates and to foster an attachment to our Alma Mater."

1895

Charles Oma Rouse, B. S. Died 1906.

Mercedes Anna Shibell, B. S., (Mrs. A. J. Gould), Toronto, Canada.

Mary Flint Walker, B. S., (Mrs. Pearl Adams), Benson.

1897

Edward Marshall Boggs, C. E., (nunc pro tunc), Chief Engineer Oakland Electric Railways, Oakland, California.

Clara Cramond Fish, B. S., (Mrs. F. C. Roberts), Tucson.

George Ojeda Hilzinger, B. S., Attorney, Tucson.

Mark Walker, B. S., Metallurgist, 211 W. First St., Los Angeles.

1898

Hattie Ferrin, B. S., (Mrs. Charles Solomon), Safford.

Granville Malcolm Gillett, B. S. Died 1912.

Minnie Watts, B. S., (Mrs. W. B. Smith), Altaville, California.

John Desha Young, B. S. Died 1899.

1899

Robert L. Morton, B. S., Assayer, Yuma.

1900

Ida Clarissa Flood, B. S., (Mrs. G. Dodge), Teacher, Tucson.

Samuel Pressly McCrea, B. S., A. B., Principal of High School, Redwood City, California.

Charles Pierce Richmond, B. S., Mining Engineer, Phoenix.

Florence Russell Welles, B. S., (Mrs. Wm. Angus), Los Angeles, California.

1901

Rudolph Castaneda, B. S., Engineer, Nacozari, Sonora, Mexico.

Clara Ferrin, B. S., (Mrs. D. Bloom), Tucson.

George Millard Parker, B. S., Denver, Colorado.

David Hull Holmes, B. S., (nunc pro tunc), Architect, San Diego, California.

1902

Andrew Gilbert Aiken, A. B., B. S., Surveyor, Canton, New York.

Moses Blumenkranz, B. S., Mining Engineer, El Paso, Texas.

Ruth Brown, Ph. B., (Mrs. Wilkins Manning). Died 1910.

Felix Grundy Haynes, B. S., Ethanaca, California.

Rose Belle Parrott, Ph. B., Teacher, Roseburg, Oregon.

Phillip Matthem Reilly, B. S.

Bertram L. Smith, B. S., Engineer, Phoenix.

Bessie Smith, Ph. B., (Mrs. Earle Davis), Douglas.

Walter James Wakefield, B. S. (Mining), Manager Tucson Warehouse and Transfer Co., Tucson.

1903

Advanced Degrees:

LL. D., Hon. William Herring. Died 1912.

M. A., John William Gorby, (B. A., Marietta), Chicago, Illinois.

M. A., Benjamin Franklin Stacey, (B. A., B. D., Lombard), Teacher, Pasadena, California.

Richard Lamar Drane, B. S., Assistant Engineer Randolph Lines, Tucson.

George Mark Evans, (LL. B., Michigan), Ph. B., Teacher, Los Angeles, California.

Leslie Alexander Gillett, B. S. (Mining), U. S. Mine Inspector, Santa Fé, New Mexico.

Georgia Ann Holmesley, Ph. B., Teacher, Clifton.

Edward Horton Jones, B. S., Assayer, Denver, Colorado.

John Willard Prout, Jr., B. S., General Manager Santa Cruz M. and S. Co., Mowry.

Thomas Edward Steele, B. S., Assayer, Sasco.

1904

William Burnham Alexander, B. S., Civil Engineer.

Elbert John Hollingshead (Kimble), B. S., Clerk, Seattle, Washington.

Estella Markham (Prout) Kirkpatrick, Ph. B., Light.

Frank Caleb Kelton, B. S., Assistant Professor of Civil Engineering, University of Arizona, Tucson.

John Willard Prout, Jr., B. S. (Mining), see 1903.

1905

Ora Elinor Norway, Ph. B. Died 1908.

1906

Advanced Degree:

M. S., William B. Begg, (A. B., Toronto), Philippine Islands.

Chester Bennett Clegg, B. S. (Civil Engineering), Phoenix.

John Wesley Gebb, B. S., Engineer, 1401 Santee St., Los Angeles.

Roy Bartley Kilgore, B. S. (Mining), Seattle, Washington.

Roy Gibbons Mead, B. S. (Mining), 2261 Shattuck Ave., Berkeley, Cal.

Roy Webb Moore, B. S. (Mining), Mining Engineer, Tucson.

Carobel Murphey, (A. B., Cox College), Ph. B., Teacher, Whittier, Cal.

Ida Christina Reid, Ph. B., Instructor, University of Arizona, Tucson.

Minnie Louise Wooddell, Ph. B., Teacher, Tucson.

1907

Advanced Degree:

Engineer of Mines, John Willard Prout, B. S., (Mining). See 1903.

Harriet Estella Brown, Ph. B., Teacher, Tucson.

Lawrence Brodhead Croasdale, B. S. (Mechanical Engineering). Died 1913.

Weda Ina Purcell, Ph. B., (Mrs. Ivy Marshall), San Francisco, California.

Hugh Maupin Wolfkin, B. S., Student, Columbia University.

1908

LL. D., William Phipps Blake, Sc. D., Tucson. Died 1910.

Carroll Pitkin Bradstreet, B. S., Pachuca, Mexico.

Benjamin Scott Dinsmore, B. S., Miami, Arizona.

William Arthur Tarr, B. S. (Mech. Eng.), Oklahoma, (Agricultural); B. S. (Mining), Instructor in Economic Geology, etc., University of Missouri, Columbia, Mo.

Hugh Maupin Wolfkin, B. S. (Mining). See 1907.

Leigh Ernest Worthing, B. S., Bay City, Michigan.

1909

Burrell R. Hatcher, B. S. (Mining), Mining Engineer, Tucson.

Ethel A. Hooper, Ph. B. Died 1912.

Grace Ysabel LaBaree, Ph. B. Died 1910.

Anita Calneh Post, Ph. B., Teacher, Yuma.

John Mosheim Ruthrauff, B. S. (Metallurgy), City Engineer, Tucson.

Arthur Perry Thompson, B. S. (Mining), Amalgamated Copper Co., Butte, Mont.

Mabel Wilkerson, Ph. B., Recorder's Office, Tucson.

1910

Ernest Orrin Blades, B. S. (Mining), Mill Foreman, Rawhide, Nevada.

Lawrence Arthur Callaway, B. S. (Mining), Lexington, Ky.

Miles Miller Carpenter, B. S., Tucson.

Fletcher Morril Doan, B. S. (Mining), Llanos de Oro, Sonora.

Ida Whittington Douglass, Ph. B., Tucson.

Warren Arthur Grossetta, B. S. (Mechanical Engineering), Tucson.

Joseph Clyde Hoyt, B. S. (Mining), Assistant Mining Engineer, Jerome.

Leslie Creighton Millar, B. S., Minneapolis, Minnesota.

Willard Henry Nash, B. S., 406 W. Ferry St., Buffalo, New York.

R. Izer Turner, Ph. B., 543 W. Chestnut St., Anaheim, California.

1911

Phebe May Bogan, A. B., Tucson.

Miles Miller Carpenter, E. M., Tucson.

Ralph Waldo Harrison, B. S., Ashland, Wis.

Miner Louis Hartman, B. S., Harvard University.

Katherine Florence Kitt, A. B., Tucson.

Duane Rebstock, B. S., Phoenix.

Jane Herbst Rider, B. S. (Civ. Eng.), Tucson.

Frank Winfred Rose, B. S. (Mining), Clifton.

Ivy Mae (Purcell) Madegan, A. B., Tucson.

Janet Volume (Sine) Lusk, A. B., Tucson.

Leon Henri Strong, A. B., Tucson.

1912

Advanced Degrees:

Bertha F. Kilgour, M. A., Teaching, Redington, Ariz.

Clarence DeWitt Thorpe, M. A., Instructor Normal School, Flagstaff.

William Jennings Bryan, Jr., B. A., Student of Law, Tucson.

Catherine R. H. Woolston Goodrich, B. A., Graduate Student at the University, Tucson.

Clara May (McNeil) Brown, B. A., Tucson.

Ella Marie Purcell, B. A., Teaching, Tucson.

John Charles Geringer, B. S., Chicago, Ill.

Otto George Geringer, B. S., Chicago, Ill.

George Howard Pratt, B. S., Assayer, 128 N. Main St., Los Angeles, Cal.

Maynard Matthew McDole, B. S. (Civil Eng.), Tucson.

James Lee Bone, B. S. (Mining), Miami.

James Joseph Flannagan, B. S. (Mining), Douglas.

Harry Wilton Lusk, B. S. (Mining), Douglas.

George S. Nishihara, B. S. (Mining), Assistant in Geology, University of Minnesota, Minneapolis.

Frank Gibbs, Certificate in Short Course in Agriculture, Stilwell, Okla.

THE STATE SCHOOL FOR THE DEAF

Pursuant to an act of the legislature of the State in 1912, a School for the Deaf and Dumb was established in September, 1912, in affiliation with and under the direction of the University. The school has its own building adjacent to the University campus.

For the year 1912-13 the School is under the principalship of Mr. Henry C. White, A. B., with Miss Harriet T. White as teaching matron. Eighteen students have been in attendance, exhausting the accommodations of the house. The work of the School has been as carefully graded as possible in this first year of its work. Additional instructors and equipment will be needed for the future and doubtless will be provided by increased appropriations by the State.

Application for admission to the School for the Deaf must be made to the Superintendent of Public Instruction at the Capitol in Phoenix, and on approval will be referred to the President of the University and to the Principal of the School, who will notify the applicant of the acceptance of the application. The requirements set by the State for admission to the School may be learned on inquiry of the Principal, who will forward the blank to be filled and returned to the Superintendent of Public Instruction. All communications should be addressed, Principal of the School for the Deaf, Tucson, Arizona.

REGISTER OF STUDENTS

GRADUATE STUDENTS

Chapin, Elsa.	Nicholson, Helen S.
Goodrich, Catherine W.	Palmer, Pearl.
Kelton, Frank C.	Rider, Jane Hebst.
Miller, James A.	Spoehr, Florence M.
Milton, Maxwell C.	—9

SENIORS

Barnes, Ernest Lee.	LaTourrette, Lyman D.
Barrett, Jas. Taylor.	Lindley, James Gary.
Brewer, William Francis.	Lovejoy, Arthur L.
Brown, Marguerite B.	Munds, Wm. Harold.
Cochran, Horace Merle.	Priddy, Irene.
Coles, Henry Oliver.	Schoonmaker, Hazel T.
Elliott, Loyd Creighton.	Swan, Laura May.
Estill, Howard Wilmot.	Wesenberg, George W.
Foster, Henry Alden.	Wilky, Guy L.
Kelly, Helena M.	Young, Ralph C.
	—20

JUNIORS

Armstrong, William J.	Merritt, Richard.
Burns, Joseph F.	Micotti, Alfred D.
Hatcher, William E.	Rogers, Fred W.
Luis, Franklin Alfred.	Wetencamp, Paul F.
MacPherson, Maud.	Wooddell, Grace Helen.
	—10

SOPHOMORES

Backstein, Rytha.	McIntosh, Jay A.
Balderas, Charles B.	Minister, Percy F.
Barkley, Bessie J.	Moore, Mabel M.
Bell, Florence.	Murphey, Walter E.
Benedict, Arthur A.	Oxley, Edward B.
Bernhard, Durward I.	Palmer, Elizabeth.
Brewer, Walter M.	Perkins, Arthur B.
Curry, Esther May.	Pickett, Chas. E.
Duffy, Catherine Gertrude.	Pistor, Carl Wm.
Ehleb, Frank A.	Record, Helen Elizabeth.
Goyette, Charles Edgar.	Rigg, Ralph Lee.
Halbert, Andrew Jackson.	Rockfellow, Julia.
Hayhurst, Normal C.	Savage, Harold Curtis.
Jackson, Lawrence R.	Scheerer, Cedric E.
Jones, Alice.	Schooling, George P.
King, William C.	Sullivan, James D.
Lawson, Alice.	Underhill, Lawrence.
Lynch, Eugene R.	—35

FRESHMEN

- Arozena, Joe De.
Beach, Charles P.
Beaton, Robert.
Bell, Ralph L.
Benzie, Inez Marion.
Boido, Rosalind M.
Bourn, Belton O.
Brinton, Mary R.
Bristow, W. Peyton.
Campbell, William R.
Carter, Charles L.
Carter, John A.
Carter, Mabel R.
Caruthers, Sam.
Catron, Frank J.
Cavanaugh, Helen C.
Clancy, Katherine.
Clark, Carl Wood.
Clawson, George Albert.
Cloud, Leo F.
Cole, David, Jr.
Condron, Albert.
Corbin, Mary.
Cornick, Frederic Joseph.
Dill, Prentice W.
Fickett, Webster L.
Gammage, Grady.
Getsinger, Joseph Wilson.
Gibbs, Gladys Virginia.
Goolsby, Arthur J.
Harpham, Harry Wm.
Haynes, John Crepin.
Hedgepeth, John Allen.
Hobson, Francis Joseph.
Hobson, Harry Townsend.
Hodgson, Gladys May.
Hoy, Catherine.
Jones, Allen Chester.
Jones, Arthur Bernard.
Jones, Collins R.
Jones, James Preston.
Kendall, Marcus Todhunter.
King, Harold F.
Kriegbaum, Lawrence Lee.
Lindsley, Richard G.
Livingston, Ruby Flora.
Logan, Edna Belle.
Mack, Francis C.
Miles, Zack Robert.
Minor, Bert.
Murphey, Charles.
O'Neill, Maurice Owen.
Parmley, Loren Francis.
Patterson, Earl M.
Pickrell, William Watson.
Piper, Marvin M.
Pistor, Anna F.
Poiser, Marguerite A.
Pusch, Maybelle.
Randall, Wainwright.
Reynolds, Ralph Lyman.
Robbins, Wm. M.
Rogers, Edgar Albion.
Rohrer, Gazelle Anna.
Rolph, Inez Katherine.
Scheerer, Geo. Wm.
Scott, James S.
Sessions, Alma P.
Shattuck, Henry.
Smith, Harry Tracy.
Smith, Turner Church.
Steinegger, William.
Udall, Levi Stuart.
Vail, Harriet Elizabeth.
Vaughan, Wallace W.
Voller, John W.
Warner, Albert.
Wells, Lucile Raymond.
Whisler, Lois G.
Woodell, Allen.

UNCLASSIFIED STUDENTS

Brainard, Bessie E.	Henley, Mrs. W. W.
Brichta, Louis C.	Lefko, Louis.
Brown, Erma C.	McOwan, Elva F.
Butler, Joel I.	Maxwell, Franklin R.
Butler, Mrs. J. I.	Miller, Helen M.
Christensen, Elmer W.	Rebeil, Paul W.
Coopman, Margaret Mabel.	Robles, Carmen Marie.
Curtis, Jennie.	Ross, Henry Davis, Jr.
Fleischman, Mrs. H. C.	Sauer, Charles W.
Freeman, Estella F.	Schutte, Carl W.
Geho, Millie A.	Smith, Roy R.
Goldsmith, Mrs. A. J.	Snow, Marguerite.
Guild, Marilla M.	Upham, Gaius John.

—26

SUB-COLLEGIATE DEPARTMENT

FOURTH YEAR

Adams, Calvert.	Nix, Margaret P.
Campbell, Hugh.	Powers, Helen.
Cavanaugh, James A.	Rebeil, Andrew.
Davey, Keith.	Renaud, Ernest James.
Davidson, Arthur Logan.	Stewart, Jeb.
Glenn, John Brooks.	Terrell, Alfred Yorke.
Glennon, Joseph H.	Troutman, Roy.
Grimes, Walter.	Wheeler, Buckley Adams.
Lummis, Turbese D.	White, Arthur L.

—18

THIRD YEAR

Amundson, Wilfred.	Jordan, Chester A.
Beavers, Bessie.	Keys, Clara Camille.
Blake, Mabel.	McClure, Frank G.
Fairchild, Sherman.	McIntosh, Sidney C.
Forbes, Helen.	Mayhew, Henry.
Hosmer, Mercedes.	Olney, Dan Clinton.
Hughes, Helen.	Schiller, Robert.
Jenney, William Le Baron.	Wait, Eugene Jacobs.
Jennings, Curtis Arthur.	

—17

SECOND YEAR

Blake, John Walter Philip.	Martin, Ina.
Branaman, William Stephen.	Renaud, Charles.
Brandt, Thomas H.	Richardson, Katherine.
Glenn, Mary Owen.	Robbins, Faye Evangeline.
Green, David Thomas.	Roberts, Helen Hunt.
Griggs, Cecil.	Stowell, Marjorie.

Taylor, Belle.	Williams, Hazel.	
Towner, Jesse.	Williams, Leo Roy.	
Whiteside, Tom Staley.	Wood, Herbert.	—18

UNCLASSIFIED

Botiller, Celeste Dora.	Hogan, Katherine.	
Chafin, Desdamona.	Langhorne, Julia F.	
Dowdle, Andrew Clarence.	Mills, James Stewart.	
Farr, Lulu.	Murdock, Henry.	
Grajeda, Bernabe.	Roberts, Carl Weston.	
Greenburg, William.	Rosenstern, Blanche Adela.	
Griffeth, Ernestina Robbins.	Rowell, Robert.	
Hardisty, Bennie Thomas.	Woo, Margaret.	
Hindman, Harold W.	Zachry, Frank M.	—18

AGRICULTURE—SHORT COURSE

Farr, Wilfred.	Sykes, Eugene.	—3
Rothlisburger, J. M.		

SUMMARY OF REGISTRATION

College Students

Graduate students	9
Seniors	20
Juniors	10
Sophomores	35
Freshmen	80
Unclassified	26
	— 180

Sub-Collegiate Students

Fourth Years	18
Third Years	17
Second Years	18
Unclassified	18
	— 71
Two Year Course in Agriculture.....	3
Short (Two Weeks) Course in Agriculture.....	77
Total attendance for the year.....	331

INDEX

- Administrative Officers, 7.
Admission, 30-34.
Advanced Standing, 33.
Agriculture, 17, 36, 37, 43, 93.
Agricultural Experiment Station, 85
Alumni Register, 98.
Assaying, Fees, 87.
Astronomy, 18, 49.
Athletics, 81.
Bachelor of Arts, Degree, 30, 34, 36.
Bachelor of Science, Degree, 30, 34, 36; B. S. in Agriculture, 36; in Civil Engineering, 30, 38; in Electrical Engineering, 39; in Mechanical Engineering, 30, 40; in Mining Engineering and Metallurgy, 30, 41; in Commerce, 42, 61.
Bacteriology, 49.
Bibliography, 49.
Biology, 19, 93.
Board, 27.
Botany, for Admission, 33; College, 50.
Buildings, 10.
Business Courses, 42, 60.
Bureau of Mines and Assaying, 87.
Calendar, 2.
Certificates of Admission, 34.
Chemistry, for Admission, 33; Sub-Collegiate, 93; College, 19, 52.
Civil Engineering, 20, 38, 53.
Climate, 9.
Commerce, Courses in, 42, 60.
Committees of Faculty, 7.
Degrees, Advanced, 42.
Degrees, Courses of Study for, 34.
Dormitories, 27.
Economics, 57.
Education, 79.
Electrical Engineering, 22, 39, 61.
Electives, for Admission, 30, 33.
Endowment, 13.
English, for Admission, 31; Sub-Collegiate, 92; College, 63.
Entrance, see "Admission."
Equipment, 10, 26.
Expenses, 28.
Extension Lectures, 89.
Faculty, 3.
Fees, 28; for Assaying, 87; for Ore Testing, 88.
French, for Admission, 32; College, 62.
Geology, 21, 66.
German, for Admission, 32; College, 68.
Greek, for Admission, 32; College, 69.
Gymnasium, 11, 25, 80.
History, Admission, 32; Sub-Collegiate, 94; College, 69.
Honors, 94.
Laboratory Fees, 28.
Latin, for Admission, 32; College, 70.
Law, 71.
Library, 10, 13.
Loan Funds, 29.
Location, 9.
Maintenance, 12.
Mathematics, Admission, 31; Sub-Collegiate, 93; College, 71.
Mechanic Arts, 21, 72, 93.
Mechanical Engineering, 22, 40, 74.
Metallurgy, 22, 41, 75.
Military, 25, 81, 97.
Mineralogy, 23, 76.
Mining Engineering, 24, 30, 41, 77.
Museum, 10, 16.
Normal Schools, Admission from, 33.
Ore Testing, see "Fees."
Organization, 8.
Physical Training, 80.
Physics, for Admission, 30, 33; College, 81.
Prizes, 95.
Records, 26.
Regents, 3.
Register of Students, 103.
Registration, 26.
Scholarships, 29, 96.
School for the Deaf, 102.
Short Course in Agriculture, 37, 48.
Spanish, for Admission, 32; College, 82.
Sub-Collegiate Department, 90.
Women's Dormitories, 11.
Zoology, 83.

THE University of Arizona
Record is published by the
University monthly during
the academic year.

Entered as Second-Class Mat-
ter at the Postoffice at Tucson,
Arizona, under the Act of
July 16, 1894.





UNIVERSITY OF ILLINOIS-URBANA



3 0112 111514110